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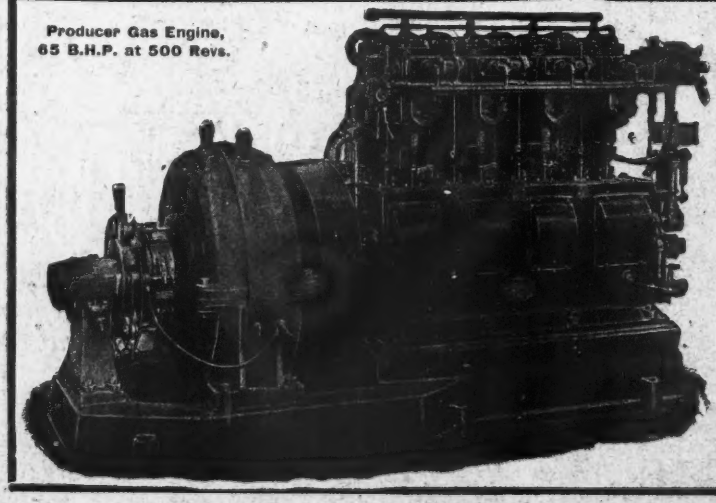

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IN view of the recent Increase in the Postal Charges, our Subscription Rates for Great Britain and Canada will until further notice be increased to £1 1s. 8d. and £1 3s. 10d. respectively.

LIGHTING CONTRACTS IN WAR TIME.

THE case of the Leiston Gas Co. *v.* Leiston-cum-Sizewill U.D.C., which was decided in the King's Bench Division on February 1st, raised a point of considerable interest to those who supply gas or electricity for lighting purposes. Yet it requires careful study, for some people may be tempted to quote it as an authority for propositions which are rather too wide. The facts are very briefly these: The plaintiffs, a gas company, undertook to provide columns, lanterns, and gas burners, to connect the same to their mains within the district of the defendants, a local authority, and to light, extinguish, and clean and repair, the lamps for a period of five years, in consideration of certain quarterly payments. The lamps, etc., were to remain the property of the gas company; but there was nothing in the agreement to show how the price payable was divided between expenditure on capital account and the sums to be paid for gas. The contract ran from June, 1911. In January, 1915, however, owing to an order issued by the military authorities under the Regulations for the Defence of the Realm, the lights were extinguished in the defendants' district. The defendants therefore refused to pay the sums due under the agreement from January to September, 1915. Upon being sued, they pleaded that the contract was either illegal or impossible to perform, and that it could not be enforced. Mr. Justice Low refused to adopt this contention. Having pointed out that the plaintiffs had not only to supply gas but to provide and maintain a number of lamps and certain apparatus, he said:—

> I do not think it is correct to say that, because in time of emergency power is given for a competent authority to suspend the actual lighting in a given area for such times as may be considered necessary for national safety, and because such power is exercised, a provision for lighting within that area becomes unlawful.

If it "became unlawful within the meaning of the authorities" the Courts could not enforce it. He next dealt with the contention that performance had been rendered impossible. Impossibility might, of course, have excused performance, but his lordship pointed out that in one respect the contract had been performed, in that the gas company had already provided the lamps and plant. Further, they were bound to "stand by" to light the district at any moment, should the lighting restrictions be removed.

The important point to note about this decision is that the gas company had to do something more than supply gas; they had to provide lamps and other plant. In that sense, and to that extent, the contract on their side was performed. It was not a case where the gas company had *merely* connected up to their mains and agreed to supply gas for a period, making no special outlay on behalf of the new consumer.

It is interesting to consider what the position would be in case a lighting restriction order was applied in a case where no outlay was necessary or actually made. Suppose, for instance, an electric lighting company are under agreement to supply all *necessary* current to street lamps for a period of five years at so much per lamp—the lamps being the property of the local authority. In such a case, it is conceived that the question whether the lamps are lit or not is a matter which concerns the local

authority. If circumstances occur which render it impossible to light the lamps, so much the better for the lighting company. As was pointed out by Mr. Justice Low, in the case under review, they would be bound to have everything in readiness to supply the load if and whenever required to do so.

Another kind of case may occur. Suppose the lighting company are under liability to supply current for every lamp and when required, subject to a minimum consumption of, and payment for, so many units. In consequence of the restriction of lighting even the minimum may not be attained; yet the local authority will still have to pay for it.

In each of the foregoing cases it seems to be clear that the lighting authority would be to a large extent protected. The loss would fall on the local authority. But where the contract is perfectly open—the local authority being entitled to demand enough light "to light the town" (or as may be) at so much a unit, it would seem that the lighting company could assert no claim for damages if, owing to the action of the military authorities acting in the interests of the defence of the realm, no public lamps could be lit.

Having regard to recent happenings, cases of these various kinds may occur in many different parts of the country. It is possible, however, that some agreements extending over a long period contain classes enabling them to be determined. In such instances no difficulty is likely to occur.

Copper.

Copper prices continue to soar under the growing scarcity which has been characteristic of the market for months past, and which has seriously alarmed consumers. The speculative account is, presumably, exceedingly small, but the position of those who have uncovered contracts in standard metal has become most uncomfortable, and there is no indication whatever of the least relief coming forward for months to come. The statistics continue to indicate a perilous condition of affairs, and the scepticism which has been expressed in some quarters for months past regarding the actual position of the metal not being as represented by the available returns, is now seen to have been wholly misplaced. The fact that the world's consumption has overtaken output is, no doubt, a very regrettable circumstance, but it is blind folly for consumers to close their eyes to the patent facts in the situation, which is entirely controlled now by what appears to be a chronic state of scarcity. In America prices have reached a higher level than those ruling here, absolute famine conditions having driven consumers into the market for immediate supplies, for which they have had to pay quite extravagant figures. American producers now are in the fortunate position of having nothing but odds and ends to sell for several months to come, and this condition shows no sign of relaxing as long as the war lasts. The American exports of copper during the last few weeks have been very large indeed, and some records have been broken. It is a matter for regret that the issuing of weekly statements as to exports of copper has been discontinued by the United States authorities, though the monthly returns will no doubt appear in due course. The United States copper exports for 1915 are given as 276,000 tons against 360,000 tons in 1914, details of the principal countries' takings for the last three years being as follows, in tons:—

To	1913.	1914.	1915.
United Kingdom ...	55,682	87,556	80,985
France	65,826	66,326	102,400
Italy	18,877	26,068	44,705
Russia	40	425	20,456
Germany	145,529	88,452	*Nil*
Austria	15,539	13,809	*Nil*
Holland	77,129	58,940	1,678

The most striking feature in the above returns is the enormous increase in the French takings, the collapse in the shipments to Holland, and also the entire absence of clearances to Germany and Austria. Russia took a good deal less copper than had been expected.

The I.E.E. and Alien Enemy Members.

At a meeting of the Chief Technical Assistants' Association which was held on Saturday last, which Association comprises practically all the deputy electrical engineers of Greater London, together with certain senior technical assistants, advantage was taken of the assembly of so large a number of corporate members of the Institution of Electrical Engineers to raise the question of the exclusion of alien enemy members, whether naturalised or not.

The Association, we understand, expressed regret that no action was taken, immediately after war was declared, to exclude such members, and complains that, though it has been in communication with the secretary of the Institution of Electrical Engineers for the past six months, it has obtained little satisfaction and less sympathy. In view of the announcement that steps are to be taken by the Council with regard to the exclusion of alien enemy members, the corporate members of the Institution who were assembled at the meeting passed the two following resolutions:—

(*a*) The corporate members of the Institution of Electrical Engineers present at a meeting of the Chief Technical Assistants' Association of Greater London place on record their unanimous dissatisfaction at the attitude of the Council of the Institution of Electrical Engineers, inasmuch as no steps are proposed to be taken to remove persons of alien enemy origin (naturalised or not) from the roll of membership of that Institution.

(*b*) They also consider that the Council of the Institution should obtain powers at the General Meeting, which it is stated is to be held, to secure a ballot by post from their members; such ballot to ascertain the exact wishes of all corporate members at present resident in this country as to whether such persons of alien enemy origin should, or should not, be retained as members of the Institution, and the by-laws to be amended accordingly.

The Association also authorised the hon. secretary to state that its members are in accord with the communication from "Six Borough Electrical Engineers" which appeared in our "Correspondence" columns on January 28th, and will support the writers in any action that they may decide upon in furtherance of the principles laid down in their letter.

In this connection we may draw attention to the notice issued by the Institution of Electrical Engineers to its members, which appears in another column, with regard to the Special General Meeting. It will be noticed that the meeting is called for 5 p.m., an hour at which only a small proportion of the members can be present. Almost the same procedure was followed in the case of the meeting held to consider the new draft Articles of Association in 1911, and called forth vigorous protests. It is difficult to understand why a more appropriate and convenient hour, such as 6.30, should not have been adopted. If the Council wishes, as we have no doubt it does, to ascertain and carry out the desires of the majority of the members, it is more likely to attain that object by consulting their convenience. The fact that the members of the Electro-Harmonic Society, prior to the concert held on Monday last, by a postcard vote decided that the concert should commence at 6.15, rather than at 7.30 or 8 p.m., is not without significance; and both the Civil and Mechanical Engineers' Institutions are commencing their meetings at 5.30 or 6 p.m.

Another point, of considerable importance, is the fact that many of the members who feel most deeply on the subject of alien enemy members—not only the rank and file, but also men of prominence in electrical engineering—are convinced that if they take any overt action against alien enemies, the latter will eventually find ways and means to strike at them, and in that thought they will not appear at any meeting, or vote in any way except by secret ballot. This, no doubt, explains the demand of the above-named Association for a postal ballot.

No provision is made in the existing Articles for the taking of such a ballot except in the case of the election of the Council; no doubt the authorities are chary of spending £20 or £25 on such a vote, but surely this is a trifle compared with the importance of obtaining the true opinions of the majority of the members, which can never be done at any general meeting. This question, however, cannot be dealt with at the special meeting, as 14 days' notice must be given.

The Italian Electro-mechanical Industry.

The first official step in conection with the scheme for securing the emancipation of Italy from the German yoke in the electromechanical engineering industry was taken at Milan, on January 15th, when Signor Guido Semenza, President of the Associazione Elettrotechnica Italiana, delivered before the members of the Association the first of a series of lectures which are to be given by way of propaganda throughout the country in favour of the development of the native industry and the definite exclusion of the Teutonic element in the future. Very appropriately the title of the address was chosen: "Dai V.D.E., all' A.E.I."—"From the Verband Deutscher Elektrotechniker to the Italian Electrotechnical Association." Taking as the starting point the fact that the rules and standards of the German Verband have hitherto prevailed in Italy, the President outlined the history of the native industry, and set forth the reasons why, after a brilliant beginning, it had to surrender its arms in face of foreign competition—the expansionist German policy, together with the irrationality of the protection afforded by the import duties and the hostility in the air, since the position in Italy in the past had been dominated by the fetish for foreign goods. When the war broke out it was found how profoundly German influence had taken possession of the Italian market, and the Association had therefore assumed the task of seeing whether it would not be convenient to promote an agitation so that the electromechanical industry might attain to that development which was its due. The manufactures of the industry were precisely those which utilised hydraulic power, which was to-day a very important branch, as it supplied the Italians with motive power. But serious difficulties stood in the way of progress, including those of the import duties, which, instead of dealing with heavy machines according to weight as at present, ought to be applied to them on an *ad valorem* basis.

The next duty of the Association, the President proceeded to explain, would be in the direction of endeavouring to persuade the Government, the provincial authorities, the town councils, and the large companies, that it would be appropriate to give a clear preference to machinery constructed in Italy. It was necessary for the machinery and materials to be of high quality and to be able to vanquish foreign competition. There had, however, hitherto been very little co-operation between science and industry in the country, whereas the German industry had reached its present degree of perfection by the application of science to all industrial processes. The Association intended in a short time to issue Italian rules and standards for the construction of machinery, which would have the effect of improving the types of machinery made. These rules, the President concluded, would be known as those of the A.E.I., and would be in opposition to those of the V.D.E., if assistance were rendered by the Government, the professors, the consulting engineers, and the manufacturers.

Telegraph Wires over Roads.—The case of the Postmaster-General *v.* Hutchings, which we report elsewhere in this issue, involved the discussion of an interesting point as to the right of the Postmaster-General to suspend telegraph lines over roads. The facts were very simple. He required to suspend lines over a building estate at Salford, across which there were certain public roads which had not been taken over by the local authority. The owner of the estate having objected, the matter was referred to the County Court Judge, who awarded that the Postmaster-General should pay £5 a year for the privilege. On appeal to the Railway and Canal Commissioners, this decision was reversed, the Court holding that for the suspension of wires over the public roads, no compensation was payable without proof of actual damage, and that in so far as his rights as an "adjoining owner" were concerned, the landowner would have to avail himself of the remedy given by Sec. 12 of the Telegraph Act, 1863. This decision applies to telephone as well as to telegraph wires, and it seems to accord with justice and good sense. It is difficult to conceive what harm is occasioned to anyone by the mere suspension of a light wire well above the surface of a road. If there is any technical wrong done, it is amply compensated by the fact that the extension of the telephone system is a boon to the public.

ELECTRICITY SUPPLY DEVELOPMENT IN A STRAGGLING INDUSTRIAL AREA.

By Lewis W. Dixon, A.I.E.E.

I had the pleasure a few years ago of describing in the Electrical Review a somewhat intricate overhead system in Dowlais in the area of the Merthyr Electric Traction and Lighting Co., Ltd., for the purposes of private and street lighting supply.

Since then another extensive development has been carried out by the company, to link up all the colliery towns

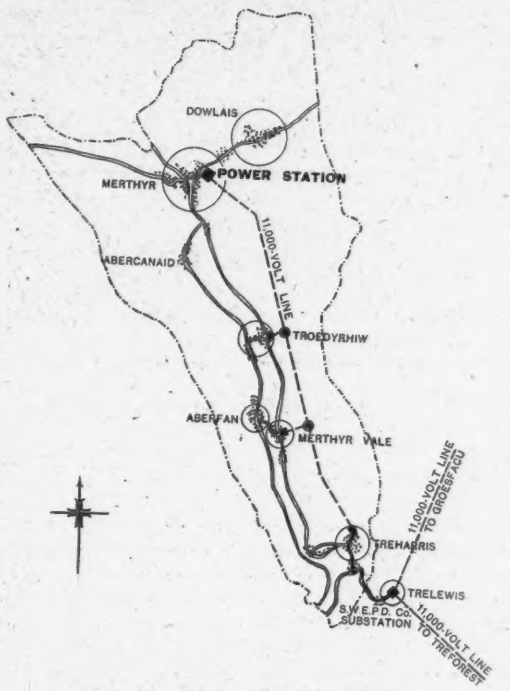


Fig. 1.—Map of Area of Supply.

in the area of supply for lighting and power purposes. The object of this article is not to lay claim to any particular engineering feat, but to show what high-voltage transmission at a moderate cost can do in industrial areas, which may prove of interest to similar undertakings that have a portion of their area undeveloped.

For some years the Merthyr Co. devoted their attention solely to the tramway, lighting and power business in the

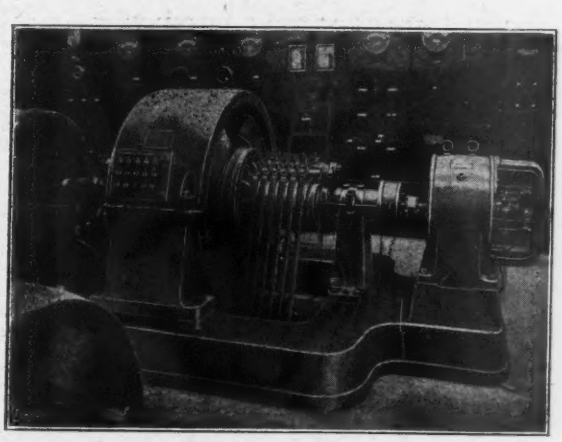


Fig. 2.—Rotary Converter Plant.

districts of Merthyr and Dowlais only; but as time went on the inhabitants of the lower districts of the borough, which are situated in a wide valley some eight miles in length, were constantly approaching the company to introduce electricity supply there also. In 1912 it was decided

to erect an 11,000-volt three-phase transmission line between Merthyr and Treharris, and to erect transforming stations and provide a low-tension distribution system in Merthyr Vale, Aberfan, Treharris and Quaker's Yard, and subsequently to Troedyrhiw as well. A periodicity of 25 cycles was adopted to enable the company to effect a junction with the South Wales Electrical Power Distribution Co. at Trelewis, which took place in March, 1914.

A rough map of the area of supply, fig. 1, shows the principal places served and a few views will serve to show

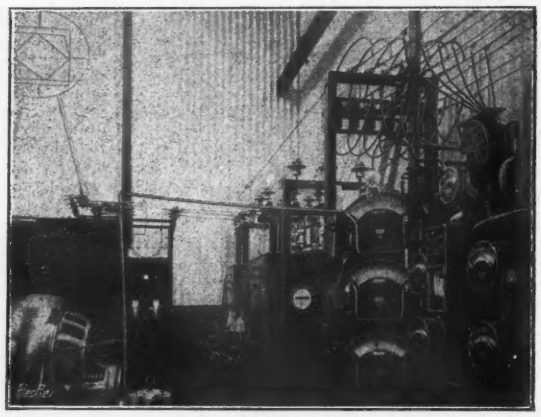


Fig. 3.—Step-up Transformers.

some of the essential features of the development. Figs. 2 and 3 show rotary converter and step-up transformer plant supplied by the British Thomson-Houston Co.

Special Plant.—The design of the rotary converter is worthy of mention, as it can be worked with excellent regulation when supplying D.C. to A.C., a direct-current booster being used to counteract the D.C. bus-bar variation, in order to keep the A.C. voltage constant. I do not believe there are many machines of its kind in the country, and the design certainly does the makers credit. The step-up trans-

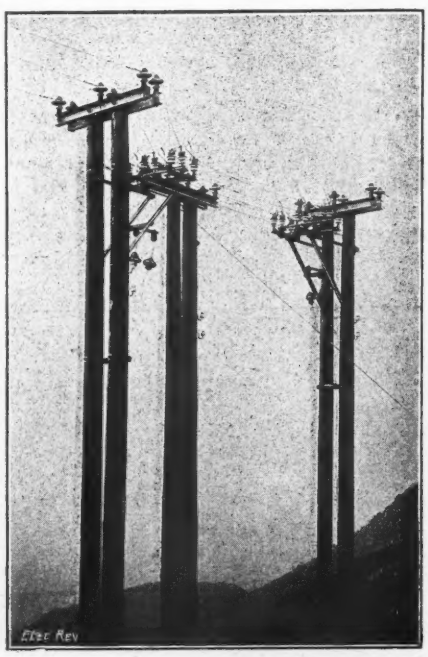


Fig. 4.—Aerial 11,000-volt Switching or Sectioning Station.

formers are three-phase, oil cooled, with half-voltage tappings on the low-tension windings for starting rotaries from the A.C. side, if required.

Transmission Line.—There is nothing very special about the transmission, except that it is probably one of the most exposed lines in the country. It had perforce, on account of wayleaves and the lie of the mountain, to be erected on the summit for two-thirds of its length (a distance of about 5 miles), and could not be in a better position for catching the full force of westerly and south-westerly winds, being at an altitude of some 1,500 ft. in places.

The exposed position of the line can be better realised by referring to figs. 4 and 5. The conductors are only ·035 sq. in.

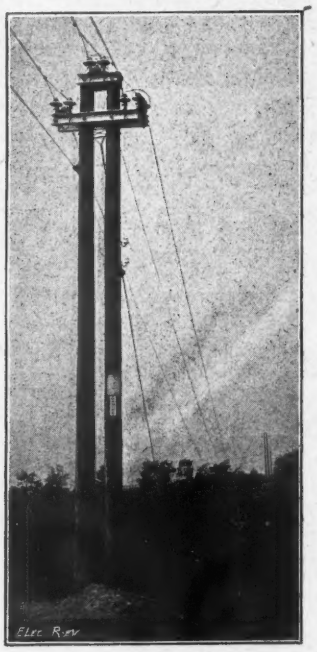


Fig. 5.—Pole Line Crossing Difficult Country.

in section, but the insulation, including a piece of underground cable, is such that the line can be converted to a pressure of 22,000 volts, if necessary.

Trouble was first experienced by conductors becoming forcibly detached from the insulators, and was overcome

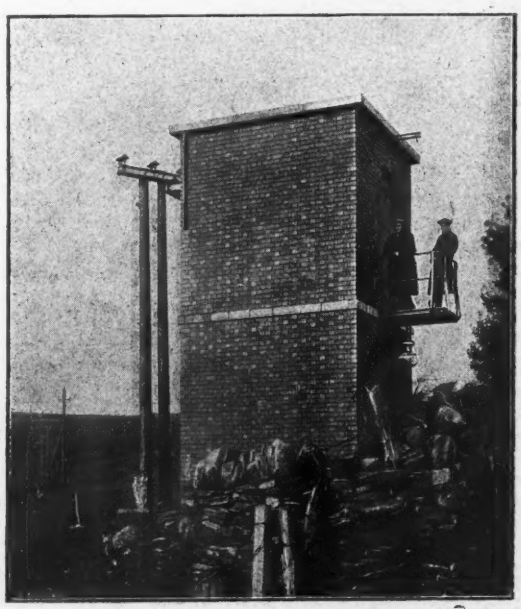


Fig. 6.—Typical Sub-station.

by using No. 8 S.W.G. check binders in addition to the ordinary chafer binders.

It is, perhaps, worthy of notice that the line was very little the worse for the hurricanes that blew on Boxing Day and January 1st last; a few poles were blown out of the perpendicular, the force of the wind being phenomenal.

A continuous copper earth-wire runs the whole length of the line, and is grounded, by request of the Board of Trade, at every fifth pole. All ironwork, stays, &c., are bonded to this earth-wire, and, should a line fall on a cross-arm, the tripping-out is instantaneous, which has been proved from experience.

Commercially, the development has been successful. The Welsh collier likes plenty of light, and there are over 300 consumers connected to the various networks.

Sub-stations.—Fig. 6 shows the standard type of building adopted by the company, with switch-chambers and lightning arresters in the top storey.

All the high-tension switchgear is the sheet steel type made by Messrs. A. Reyrolle & Co., Ltd., which, so far, has given every satisfaction.

Transformers are provided in duplicate, and are all three-phase, oil-cooled, and made by the Brush Co.

There is every prospect of an increased demand, and it is possible that more rotary plant may be installed at Merthyr to deal with the tramway and lighting load in the main town of Merthyr. All this development work, as in the case of Dowlais, &c., was designed and carried out by the writer and staff.

In conclusion, it may be of interest to mention that the company's generating station is built on the site of the old Penydarren Iron Works, where the first steam locomotive to run on rails was made for goods traffic by Richard Trevethick some 106 years ago.

THE FRENCH ELECTRICAL INDUSTRY.

About a year ago the French Société d'Encouragement pour l'Industrie Nationale suggested that an investigation should be made into the question of the means to be adopted for competing with German industry after the war. M. Hillairet, with the authority which is associated with one of the founders of the French electrical industry, responded to the call, and showed that the French had no reason to be envious of their rivals from the standpoints of staff and workmen, execution, price and the quality and abundance of raw materials. It was also contended that the home market could be fully supplied by native firms without having recourse to other countries, and that, with some efforts, the manufacturers would be able to increase their exports, whilst customers, with some consideration, could reduce their imports almost to a negligible quantity. In this connection our contemporary, *L'Industrie Electrique*, recently endeavoured to prove how this result may be accomplished. The journal leaves out of account the question of carbons, the progress in the manufacture of which more than balances the French inferiority in porcelain; lamps, which are in process of complete transformation; and secondary and primary batteries, which only represent a small fraction of the foreign trade. As a consequence, the discussion is devoted solely to machines, apparatus and cables, which comprise 82 per cent. of the value of the total imports. The accompanying table gives the values for the four years ended with 1913:—

The French Turnover in Machinery, Apparatus and Cables.

	Imports.	*Exports.*	*Imports.*	*Exports.*
	1910.	**1910.**	**1911.**	**1911.**
Dynamos... ...	£339 000	£128 000	£370 000	£186,000
Electrical apparatus ...	481.000	212 000	573,000	369.000
Armatures and parts ...	140.000	173 000	123,000	110,000
Total	£960,000	£513,000	£1,066 000	£665,000
Difference in favour of imports	£447.000		£401,000	
	1912.	**1912.**	**1913.**	**1913.**
Dynamos...	£353,000	£119,000	£362 000	£164.000
Electrical apparatus ...	677,000	423,000	740,000	583 000
Armatures and parts ...	150,000	132,000	184,000	98,000
Total	£1,180,000	£674,000	£1,286,000	£845,000
Difference in favour of imports	£506 000		£441,000	
	1910.	**1910.**	**1911.**	**1911.**
Cables and wire... ...	£9,900	£70,000	£23,000	£142,000
Difference in favour of exports	£60,100		£119 000	
	1912.	**1912.**	**1913.**	**1913.**
Cables and wire... ...	£24,000	£118,000	£66,000	£136,000
Difference in favour of exports	£94 000		£70,000	

It will be seen that notwithstanding the increase in the absolute values, the difference between the imports and exports has remained substantially constant, being an average of £448 000 for machines and apparatus, while the difference in the average for cables and wires has been £85 000. Among the causes adduced to explain why the efforts made to break through this constant difference have not succeeded is mentioned the scarcity of labour, which becomes accentuated every year. The quality of the manufactures is declared to be excellent, and, notwithstanding the higher cost of materials, it is possible to maintain competition by accepting reduced profits, but owing to the lack of labour it is impossible to produce in adequate quantities and consequently with sufficient rapidity. It is admitted that the French are invariably beaten on the question of the period required for delivery. The same reason must be attributed as the cause of the weakness of the export figures as compared with those of German industry. The importance of this cause of inferiority arises from two facts. In the first place, the progress made is much more accentuated in the case of electrical apparatus, which is manufactured above all in Paris, where skilled labour is relatively abundant, than in the case of machines, which are generally made in the provinces where labour becomes scarce. Secondly, in regard to cables and wire, in the manufacture of which labour only plays a secondary part, there is a surplus of exports, whilst for machines and apparatus, where the proportion of labour in the cost price ranges from ⅓ to ½, the imports have the advantage. Without wishing to conclude that the scarcity of labour is the sole cause which hampers the development of the industry, our contemporary affirms that it is an important factor in the situation.

If there are left out of consideration other causes of a general kind, such as banking and commercial organisation, the question arises as to what the national resources in labour will be after the war. The results hitherto achieved will probably be reduced then owing to the voids brought about through deaths and incapacity; while, on the other hand, the labour requirements throughout the country will be increased for numerous purposes. It is, therefore, necessary to consider directly the problem of how to produce as much as possible, and even more than hitherto, with the aid of fewer workmen, and at greater cost. In the course of a lecture delivered before the Société d'Encouragement, M. H. Ernault recommended the use of improved plant and the adoption of specialisation for mechanical construction; in other words, the production of standard types. What is good for the latter should also be good for the electrical engineering industry. But as soon as the electrical industry wishes to embark upon this path it is going to meet, particularly in the home market, with great difficulties and deplorable customs. Each purchaser has assumed the habit of asking for a particular machine to fulfil his special requirements, which are almost fantastic. He compels the maker to lose his proficiency and his money in undertaking perpetual investigations, to make patterns constantly, and to change his winding, which requires much time and labour, and is opposed to the use of improved machinery, rapidly producing excellent products at low prices and with a minimum of labour. Very often the maker refuses the order, and the intending customer then applies to a foreign firm, who accepts, or pretends to accept, the conditions. In the opinion of the French journal, it will be necessary to struggle with the greatest tenacity in order to bring about a change in such disastrous commercial morals.

An initial step in this direction, it is contended, should be taken by the unification of specifications for machinery, transformers and cables. Starting from three different principles—the defence of the interests of French industrialists or the interests of buyers and the scrupulous respect for scientific data—the Union des Syndicats de l'Electricité, the Association de Propriétaires des Machines à Vapeur, or the consulting engineers and the Comité Electrotechnique, have recommended conditions to be imposed upon makers. These conditions which are far from being in agreement, are a great obstacle to the creation of standard types. If, however, an appeal be made to each of these Associations, it is considered that each will be able, without abandoning its legitimate claims, to adapt them to the needs of an industry which requires aid to overcome the difficulties which threaten it, and to place it in a position to compete on equal terms in foreign markets. Circumstances more favourable for the purpose than those now obtaining will never be met with again. Everyone feels to-day the need for sacrificing his opinions as an individual in favour of the general interest—the superior interest of France. It is to this work that the journal would like to see manufacturers devote their efforts, as it would represent, our contemporary concludes, an excellent response to the patriotic wishes expressed by M. Hillairet some time ago.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Universal Test Clips.

We have received from the L.P.S. Electrical Co., of 18, Adam Street, W.C., particulars concerning their "current-carrying" Universal test clips, which we illustrate herewith. These are particularly designed for making quick temporary electrical connections when testing telephonic, telegraphic or power apparatus.

Fig. 1 shows the No. 8 size for 15 amperes; it is made in copper, with an internal spring, and the toothed jaws, having a spread of $\frac{11}{16}$ in., are suitable for gripping either fine wire or storage-cell lugs. To attach the clip at its other extremity to the other wire, the latter is bared of insulation a little way, and the end inserted in the hole in the heel of the clip and soldered in place; the lips of the trough are then pinched over the insulation to put the strain on the latter. The heel of the clip can then be taped over.

Fig. 2 shows a 20-amp. clip, arranged for screw connection at the heel, the bared wire being secured under a washer or cleat,

Figs. 1 and 2.—Testing Clips with Soldered and Screwed Connections respectively.

and the adjacent lips being pinched over the insulation of the connecting cord. Standard 100-amp. clips are made, which will carry 200 amps. for a short period.

These clips can be supplied with rubber insulating covers to protect the user from shock and prevent short-circuiting with adjacent terminal clips. These covers are coloured red and black for distinguishing polarity, &c. Special lead-plated clips, with enamelled springs, are supplied for storage-battery charging.

The Premier Electric Suction Cleaner.

We were recently enabled, by the courtesy of the Electric Suction Cleaner Co., of 56 Victoria Street, S.W., to inspect the latest patterns of their "Premier" suction cleaner, which has been developed up to a high degree of perfection. Fig. 3 shows

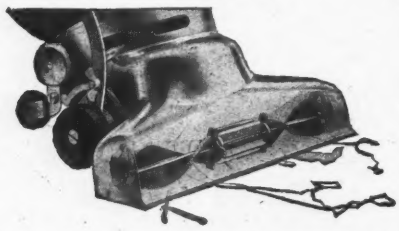


Fig. 3.—Ghost View of Premier Cleaner, showing High-speed Revolving Brush.

the ordinary or domestic type, which is operated by a vertical motor, and is provided with a revolving brush (to pick up threads and lint) in the nozzle driven at high speed by the incoming air, a roller at the rear which is adjustable to suit the nap of carpets or upholstery, a switch in the handle, an adjustable yoke, and a variety of attachments for the many purposes for which such

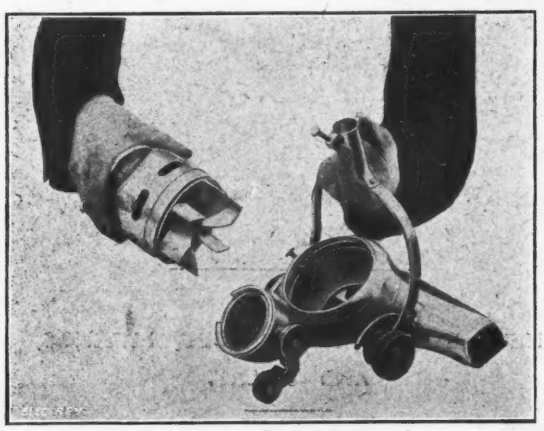


Fig. 4.—Motor and Fan removed from Head of Cleaner.

machines are suitable, either as suckers or blowers. The brush is here shown as if the nozzle were transparent, and is provided with curved blades upon which the air-current impinges. The motor, which is a beautiful piece of work, and is made for pressures up to 260 volts, D.C. or A.C., can be lifted out very easily, together with the fan, which has blades of a particular shape found by experiment to be best adapted to the purpose (fig. 4). The position of the switch in the handle, which has an insulating cap so that the user is secure from possibility of shock, is shown in fig. 5. Wherever possible, the metal parts are made of aluminium, and the convenience of the user has been carefully studied.

The pattern shown in fig. 6 is a novel development intended for industrial use; by means of a specially designed belt it can be

Fig. 5.—Switch on End of Handle.

attached to the waist of the user, leaving both hands free, so that he can use the cleaner at the top of a ladder. Alternatively he can carry it by a substantial handle. This type is particularly suitable for use in stores, warehouses, theatres, cars, &c., being extremely handy and convenient. In the main the industrial cleaner is identical with the domestic type.

The company point out that the electric suction cleaner is not a toy, nor is it an article of luxury; it has become a very necessary domestic aid, especially in these days when servants are scarce. The "Premier" is made for all voltages from 25 to 260 volts, and

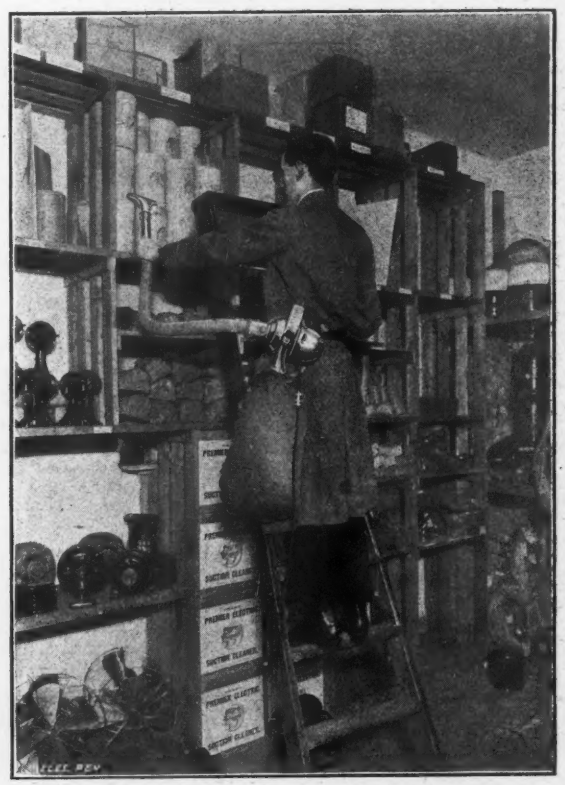


Fig. 6.—Premier Industrial Cleaner in use.

all frequencies from 25 to 133. Careful tests by independent experts show that the special form of fan blades that has been developed enables the machine to give a pressure equivalent to more than 10 in. water gauge, and in the industrial type a still higher pressure is attained. The device has proved to be exceedingly effective for switchboards, and is specially useful for cleaning filter cloths in turbine stations, as well as for many other purposes.

Commercial Vehicle Inspection.—The Electric Vehicle Committee of the I.M.E.A. is providing three cash prizes in connection with the tenth annual inspection of commercial motor vehicles, organised by the Commercial Motor Users' Association, to take place in May.

TESTING UNDERGROUND CABLES.

At the meeting of the Institution of Electrical Engineers on February 10th, Mr. O. L. Record, A.M.I.E.E., read a paper on the testing of underground cables with direct current by means of the Delon apparatus. The author pointed out that as there was no definite relation between insulation resistance and dielectric strength, it was necessary to measure the latter directly, and in order to provide against possible pressure rises, it was usual to make tests on cables in the course of manufacture at not less than twice the working pressure for which they were intended. It was also necessary to apply similar tests after laying the cables, and the Engineering Standards Committee specified that such tests should be made at about twice the normal voltage for a period of 30 minutes. In the case of cables for moderate pressures this presented no difficulty; usually a small transformer could be taken to the spot. But when cables for high pressures and of great length were concerned, difficulties arose. The apparent power, and therefore the dimensions of the transformer, increased as the square of the test pressure and as the capacity of the cable, and consequently the weight of the transformer became excessive. For example, the apparatus required to test 15 km. of 3-core cable at 6,000 volts after laying might weigh as much as 25 tons. In such cases the tests after laying were often not made, and the lack of certainty regarding the condition of the cable caused uneasiness. On this account it had been proposed to make the tests with continuous current at a pressure equal to the maximum reached in the case of alternating current.

It had been shown that the breakdown voltage for a dielectric under alternating pressure was a function of the time of application, and of the frequency employed, tending to decrease as the time was prolonged or the frequency increased; and for a given cable this reduction of dielectric strength by the application of a high-pressure test was permanent. Consequently, manufacturers were strongly opposed to the application of an A.C. test higher than the working pressure being

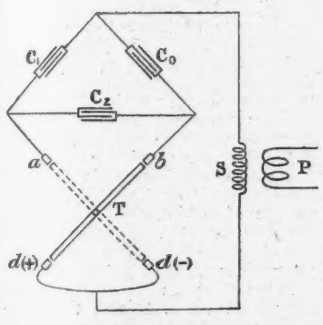


Fig. 1.—Principle of the Delon Apparatus.

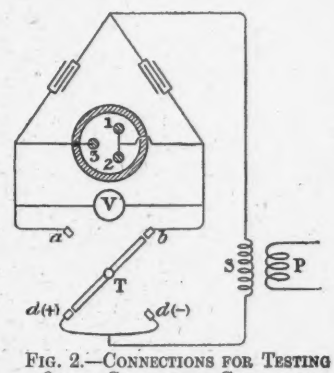


Fig. 2.—Connections for Testing a 3-core Cable with Condensers.

repeated on cables for which they had undertaken the guarantee, and this had the unfortunate result that supply engineers were prevented from employing this method of ascertaining the condition of their mains from time to time; hence another method of testing was desirable.

Testing by continuous current had the advantage that, once the cable was charged, no more energy was expended, no matter what the capacity of the cable, provided that the insulation was good; therefore tests after laying could be carried out with apparatus of small power. Moreover, observation had shown that such tests did not fatigue the dielectric, and the period of application had no effect on the breakdown voltage. Hence, with continuous current supply authorities could repeat their tests as often as desired without objection on the part of the cable manufacturers, and at the same time they could determine the insulation resistance of all the feeders.

The Delon apparatus worked on a principle described by the author as follows:—

The essence of the apparatus is a high-tension contact-maker which charges condensers by making at each half period a connection through a short spark between the transformer and condenser to be charged. By means of a suitable arrangement the contact is made at the moment when the electromotive force is at its maximum value, and, by means of auxiliary condensers, the voltage of one half-period is added to that of the other, with the result that finally the principal condenser is charged to a pressure double the maximum of the alternating current employed.

As shown diagrammatically in fig. 1, the contact-maker formed by a conductor, T, embedded in an ebonite disk, revolves round a spindle perpendicular to the plane of the disk. Four fixed brushes are placed a very short distance from the disk in such a manner as almost to make contact with the conductor when the latter passes between them. These four brushes are placed at the extremities of two diameters which are perpendicular to the axis of the disk. Two of the adjacent brushes *d* are joined together and connected to one of the secondary terminals of the transformer. The other two brushes, *a* and *b*, are connected each to an apex of the triangular group of condensers to be charged, the other apex being joined to the second terminal of the transformer S.

The disk is driven by means of a synchronous motor fed from the alternating-current circuit which furnishes the high-tension current by means of the transformer. The group of fixed brushes can be placed at a convenient angle to allow of their coming opposite the moving conductor at the moment of maximum voltage; the condenser C_2 to be charged, and the two auxiliaries C_0 and C_1 form a triangle.

At the outset, the synchronous motor being started, if the primary circuit of the transformer is closed the moving conductor T passes, say, first of all between the pair of fixed brushes *b* and *d* (+). The condenser C takes a charge which depends on the self-induction of the transformer and the maximum voltage of the secondary current. The other two condensers C_1 and C_2 take a charge such that the sum of their potentials v_1 and v_2 is equal to the potential, v_0 of the condenser C_0.

At the following half-period it is the condenser C_1 which is directly connected to the secondary, and as the direction of the current is changed this condenser is charged in the same direction as in the previous case. The condenser C_0 on the contrary, receives a charge in the opposite direction to the first. As a result the condenser C_2, which is the one that it is desired to charge up to a high potential, receives charges which are always in the same direction, whatever the position of the moving conductor. The quantity of electricity supplied at each contact will then charge simultaneously one of the two auxiliary condensers in parallel with the group formed by the secondary auxiliary condenser and the condenser C_2. As the time during which contact is established between the transformer and the condensers is very short, and as, moreover, the self-induction of the secondary of the transformer is considerable, the quantity of electricity that can be introduced into the system at each half period is limited, but the repetition of the phenomenon is so rapid that at the end of a relatively short time the condenser C reaches a potential equal to twice the maximum pressure of the alternating current. In practice the charging-up is effected in less than a minute at a frequency of 50, that is, in less than 6,000 contacts.

The word "contact" signifies the passage of the conductor past the fixed brushes and not actual contact, the closing of the circuit being always produced by means of a spark, very short and of low resistance. With such a system it is possible to reach continuous charges as high as desired by using transformers of only comparatively small power.

The author then went on to state that the whole of the apparatus could be carried on a handcart, the total weight being about half a ton, so that two men could easily wheel it. The cart contained a small switchboard, a synchronous motor and contact-maker, the auxiliary condensers and the transformer. The conductor T (fig. 1) was completely embedded in an ebonite disk except at the ends, and the four contacts were mounted on an ebonite carrier which could be rotated to give the brushes the correct position. The transformer was wound for 110 and 220 volts on the primary side, and gave 15,000 or 30,000 volts on the secondary side. Hence it could be used for a continuous pressure of $2 \times 30{,}000 \times 1.4 = 84{,}000$ volts, and by increasing the primary voltage a test pressure of 100,000 volts could be attained. Apparatus for 150,000 volts could be made portable, but for higher pressures the sparking distances became too great to be dealt with on a handcart. The transformer need not be larger than 3 KW. The electrostatic voltmeter should not be carried on the cart.

Fig. 2 shows the connections for testing a 3-core cable, which takes the place of the condenser C_2. One of the conductors is connected to the lead and then to one of the fixed brushes, and the other two conductors are joined together and connected to the second brush. The two condensers are joined together and their common point is connected to one of the secondary terminals of the transformer. As will be seen, the test is made between conductors 1 and 2, and conductor 3 and the lead. In order to complete the test it is therefore necessary to make a second test, joining conductors 1 and 2 to the lead and the other two conductors to the fixed brush *b*. In actual practice the auxiliary condensers are usually dispensed with, the cable itself providing the capacity.

Fig. 3 shows the connections for a 2-core cable. In this case one of the conductors of the cable is subjected to a pressure always of the same sign and equal to the maximum positive value of the alternating electromotive force, viz., $+ E\sqrt{2}$ and the other to a pressure equal to the maximum negative value, viz., $- E\sqrt{2}$ so that there is at any instant between the two conductors under test a difference of potential equal to double the maximum voltage, viz., $2E\sqrt{2}$.

The same test can similarly be applied between either conductor and the lead, and cables with three or four conductors can be tested as shown in fig. 4, where the maximum pressure is established between cores 1 and 2, and the lead.

In the case of single-conductor cables, which are usually used for low pressures, a test pressure up to 100,000 volts can

be applied by connecting the core to one brush only and leaving the other idle.

For measuring the pressure, the author recommended the Abraham-Villard electrostatic voltmeter as a really practical apparatus, easy to set up and to pack in a case.

As a continuous current test does not fatigue the dielectric, the question arises whether the continuous pressure and the A.C. pressure are equivalent in effectiveness. The author quoted experimental observations showing that a continuous pressure only produced the same breaking-down effect as an alternating pressure of one-third to one-fourth its value. It had been proved possible to reduce the resistance of a fault by the Delon test sufficiently to enable its position to be ascertained by the ordinary methods. The system had been definitely adopted by several important electric supply undertakings on the Continent, and the tests could be applied at frequent intervals without harm to the cable. Tests made

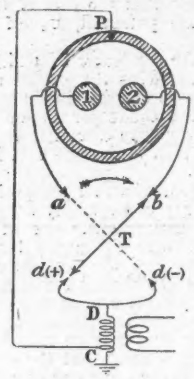


Fig. 3.—Connections for Testing a 2-core Cable.

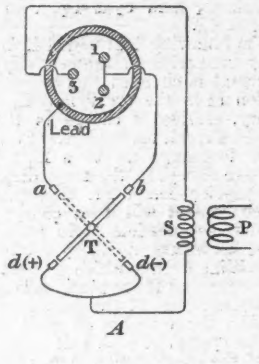


Fig. 4.—Connections for Testing a 3-core Cable.

with the oscillograph showed that the pressure variation was less than 8 volts in 30,000, so that the pressure was much more constant than that of a dynamo.

If the cable makers and supply authorities could agree as to the proper test pressures to be adopted, all objections to the use of the method would disappear.

In an appendix the author gave particulars of German experiments on the system, which showed a ratio of effectiveness in producing breakdown of about 1 to 2.6, compared with alternating current. A portable plant rated at 10 K.V.A. was provided with a 500-volt 50-cycle supply for the primary of the transformer by a petrol-driven alternator of 9 KW.; the apparatus was carried on two wagons, weighing in all 8 tons, and could test as much as 50 km. of cable to 150,000 volts.

Discussion.

The discussion was opened by Mr. Welbourn, who felt that some mention should have been made of the work carried out in direct-current testing by others. There was nothing new in using direct-current machines for testing networks, it was common practice 15 years ago, but fell into disuse with the growth of alternating networks for various reasons, one being the flimsy character of the D.C. high-voltage machines which were available. It had, however, been a matter of considerable thought whether there should be a reversion to direct-current testing, which was quite practicable in view of the high voltage D.C. machines now available. Transformer equipment for testing completed A.C. installations was a serious item and would be more so with the 33,000 and, possibly, 50,000-volt cables which were coming, so that some suitable alternative method, such as suggested, was wanted. But it was necessary to satisfy the user that the method was a practicable one; the 14 minutes mentioned to burn out a fault might not be practicable, but he believed that the static discharge through a puncture would give the cleanest burn-out possible. As to the nature of the current produced by the apparatus, he would have been glad to see some oscillograph records. The curve showing the relation between A.C. breakdown voltage and duration of test was exactly similar to one published in Sir John Snell's book, and prepared 10 years ago from tests on the first 20,000-volt cable made in this country. He was uncertain whether the author's remarks on dielectric fatigue would hold good with modern cables.

Mr. A. P. Trotter suggested that more consideration should be given to the period of time in testing, as it was open to doubt whether half-an-hour was really necessary.

Mr. F. C. Raphael said that the paper by Mr. Evershed and discussion on a similar subject contained much information as to what actually occurred in the cable. The strain resulting from direct current must be entirely different from that with alternating current, and they must still have the factory test; further, some kinds of fault would probably not be broken down with the direct-current method.

Mr. Watson referred to some experiments carried out by himself with a view to testing a large cable at 150,000 volts with an influence machine, built on practical engineering lines. Unfortunately, the result was not entirely successful; the machine was run in compressed air for dielectric reasons, and was built to give ½ KW. at 150,000 volts. It had 30 revolving plates 12½ in. dia., and metal sectors of sheet brass, while the stator consisted of steel plates built up into units mounted on ebonite insulators—all glass being done away with. The machine was separately excited by an exciter through which the output of the main machine was controlled. In the end the machine broke down by the general disintegration of the ebonite, and he thought they had possibly neglected precautions which were not found necessary with a small machine.

Mr. Warren said some simple means of varying and controlling test pressure were, he supposed, included with the Delon apparatus. The single-core cable testing arrangement should receive every attention as far higher pressures would be used with single than multi-core cables. The use of the apparatus seemed complicated, because the actual D.C. pressure was a variable; and the small power available for localising faults was not very convincing, but the apparatus certainly got over the transformer difficulty.

Mr. H. M. Sayers said the author had left out one of the greatest advantages of D.C. testing, *i.e.*, it was possible to measure the actual dielectric resistance of the cable. This was of direct interest to the man in charge of the cable network, as it gave him an indication of coming trouble before the cable broke down. The usefulness of the cable sheath was proved by experience with lead-sheathed single-phase cables; the earthed outer gave an indication of coming faults. In testing he had often found it advantageous to run the engine of the testing set slower and reduce the frequency, thus reducing the size of transformer plant required.

Mr. Rosling said the Delon apparatus was a reasonable proposition from the cable maker's point of view, and it would indicate moisture in cables being laid better than A.C. testing. Installed cables were tested for the joints, and long lengths could be cut into sections, the final joints being made under the personal supervision of the engineer, which was the best method of ensuring a sound joint.

The President felt that the paper rather reflected on British cable makers. Cables underwent an A.C. test during manufacture, but after laying it was only a question of testing joints. Up to now there had been no great difficulty in testing with transformers, but when they began to use 30,000-volt cables, the Delon apparatus became of interest—for testing joints, not cables. There was no continual pressure testing under present conditions, as implied in the paper; only rarely were there accidents involving such testing.

The Author, in replying, pointed out that the title of the paper might have misled them; it was not intended as a treatise, and only referred to higher pressure cables than now in use; also, it was intended to describe a particular apparatus. He quite agreed with A.C. testing in the factory, but it must be noted that with pressures of 30,000 or 40,000 volts there would not be the same margin of safety, and greater precautions would be necessary subsequently. He thought Mr. Evershed's paper only dealt with the first part of the curve showing relation of pressure to time of test, but breakdowns occurred in the second part. The Delon apparatus was provided with suitable resistance on the L.P. side of the transformer to vary the test pressure.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Salaries in Power Stations.

The Electrical Review for January 21st has just come to hand (after its journey of nearly 3,000 miles), and I note that Mr. Ebben, the energetic hon. secretary of the A.E.S.E., has replied to my letter and taken up the subject of power-station salaries. I am afraid he has not taken the spirit of my letter in quite the right way, for I have no personal grievance at present, and the letter was written in an honest endeavour to draw attention to what is really a most important matter. I have been in a position to appreciate Mr. Ebben's good work for the benefit of station engineers, having taken an interest in the Association since its inception in January, 1913, and also having proposed or seconded for election several of its present members.

In my letter, kindly published in the Review under date of January 7th, I endeavoured to point out the unsatisfactory, and even dangerous, state of affairs existing in many power stations owing to shortage of staff, and also to put underpaid charge engineers and technical assistants on their guard in the event of central stations becoming "controlled establishments," as I have very good reason to believe that certain managers have left no stone unturned to secure the protection of the Ministry of Munitions in their self-made plight.

The Ministry of Munitions may intervene, and, being a Government department, their knowledge of electrical station matters will probably be on a par with that of other Government departments; and as the managers will not enlighten them, for obvious reasons, the position of technical assistants

may be worse than in the *ante bellum* period, for they will be treated as mere operatives in a controlled establishment.

I fully agree with Mr. Ebben when he says that station engineers must follow the lead of their managers and build up a strong association themselves, instead of waiting on the I.E.E., the B.O.T., or the Home Office; but, unfortunately, of late very little interest has been evinced in the subject, and one can only conclude that if the present apathy continues the end of the war will find station men in a very backward position with regard to their own interests. Owing to shortage of staff and the craze for cheap labour, young women are being successfully employed in power stations, and it is interesting to note that for at least seven months now an important municipal power house of some 23,000-KW. plant capacity has employed on all three shifts female switchboard attendants. Who knows but that we may see in the *post bellum* period managers advertising in the REVIEW for charge engineers, married men preferred, wife to act as switchboard attendant, combined salary 35*s.* per week of seven 8-hour shifts!

If station engineers could look ahead they would see the futility of a "wait and see" policy, even during the present European crisis, for undoubtedly this is no time for any man worthy of the name to remain an inert mass. If central station men are not required in H.M. Forces, their energies should be directed towards improving their status and conditions of employment by the honourable means at their command, and in this connection I am glad to note that the official policy of the A.E.S.E. is still against that detestable weapon of Labour—strikes.

Undoubtedly the Association has a future before it, particularly if it tackles the question of competency of engineers, for I am convinced that at present the chaotic state of the profession is largely due to there being no standard of training required, and rather than "kick against the pricks" it would be to the advantage of chief engineers to encourage the pioneer work of the A.E.S.E.

Chief Assistant.

Malta, *February 3rd*, 1916.

WAR ITEMS.

Copperless Machines in Germany.—About two or three months ago we referred to the Government notice issued in Germany imposing upon electrical firms the obligation to make a return of the dynamos, motors, transformers, apparatus, etc., in stock, and in which copper was used, so that the military authorities might requisition these machines, etc., as occasion might arise. In this connection a further notice of a remarkable kind has now been published. It states that the electrical firms have been constructing transformers having zinc windings for some time past, and that they are now engaged on the production of generators and motors with windings made entirely or partly of zinc and commutators of steel, for which principles have already been settled by the Union of Electrical Engineers. As doubts have arisen as to whether electrical machinery and transformers in which no copper is used come within the scope of the notice regarding the obligatory return previously mentioned, the second notice announces that this is not the case. But in those instances where copper is partly employed in the construction of machines, transformers, and apparatus the original obligation holds good. At the same time, it is stated that the voluntary notification of machines possessing no copper is admissible.

Licences for Export.—The Director of the War Trade Department calls attention to the fact that where a licence is granted for the export of prohibited or restricted goods the licence does not relieve the owner of the goods, or the consignor or other person to whom the licence is granted, from any responsibility to which he may be liable for any breach of law or regulations. It is therefore incumbent on persons before applying for licences or exporting goods to take all reasonable steps to satisfy themselves that the ultimate destination and intended use of the goods are unobjectionable. Failure to do so may involve serious consequences.

Trading with the Enemy.—The Board of Trade has appointed Mr. E. R. Moon, C.B., K.C. (chairman), the Hon. J. D. FitzGerald, K.C., Sir G. Croydon Marks, M.P., and Mr. Gershom Stewart, M.P., to be a committee to advise it on matters arising under the Trading with the Enemy Amendment Act, 1916. Mr. W. P. Bowyer is secretary to the committee, and all communications should be addressed to the Board of Trade, 38-39, Parliament Street, S.W.

Australian Preference.—It is announced that the New South Wales Government has recently had under consideration the question of preference to British manufacturers, and has decided that in the purchase of supplies for the public service of New South Wales a 10 per cent. preference shall be extended to local British or Empire manufacturers as against those of other countries.

Prohibited Exports.—The exportation of carbon electrodes for electric furnaces has been prohibited by an Order in Council.

Munitions Manufacture in Italy.—La Società Partenopea per Industrie Metallurgichi ed Elettriche is the name of a new undertaking which has lately been formed in Naples with a capital of £40,000, mainly to engage in the manufacture of war munitions.

Station Men with the Forces.—The Lowestoft T.C. reports 20 electricity works employés on active service. One, Mr. W. Smith, has fallen in action in Flanders, while 18 have received war badges.

Controlled Works.—The number of establishments controlled by the Minister of Munitions on February 10th was 2,834.

THE HIRSCH PORTABLE ELECTRIC LAMPS.

On February 12th, Mr. Hiram H. Hirsch read a paper before the N. of E. Institute of Mining and Mechanical Engineers, describing the Hirsch lamps, which, though largely used in the United States of America, have not yet been adopted in Great Britain. The lamps have been designed for use by watchmen, and in mines, and other places where special precautions become necessary on account of the presence of explosive materials or gases. They are operated by a storage battery contained within a casing.

The hand-lamp is provided with a storage battery placed on an asbestos cushion, in a cast aluminium casing with a hinged top. The top piece is also of cast aluminium, and is provided with a hook, a reflector, and terminals for making contact with both poles of the battery. The reflector unit consists of concentric safety shells, an incandescent lamp, a safety glass, a crystal, and a switch.

The battery consists of two horizontal lead plates, each about an inch thick, placed in the bottom of an ebonite jar, and separated by wood and perforated ebonite, the bottom plate being positive. The positive and negative leads extending from the battery-plates are enclosed in glass tubing. The solidified electrolyte consists of a gelatinous substance developed by the manufacturers. The battery is provided with a vent-plug, and the top of the battery is sealed with an insulating compound. The terminals consist of antimonious lead.

A magnetic spring lock is housed in the bottom casing, and a rubber cushion is placed in the bottom.

The reflector is constructed with three concentric shells, the intermediate shell being insulated from the other two and connected to the negative pole, and the other two shells to the positive pole of the battery. The distance between these shells varies at different points from $\frac{1}{32}$ to $\frac{1}{4}$ in. The shells are so arranged that if the reflector should be crushed or punctured, the current to the lamp would be cut off by the shells being short-circuited between the battery and the lamp before the lamp-bulb could be broken.

The incandescent lamp used is of the 2-volt 0·55-ampere tungsten-filament type. The safety glass consists of a piece of window glass $2\frac{1}{16}$ in. long, 1 in. wide, and about 0·05 in. thick, supported across the reflector shell behind the crystal.

The miner's lamp consists of a storage battery placed in a cast-aluminium box designed for mounting on the miner's belt. The box is supplied with a handle, and contains the necessary contact springs for making contact with the battery terminals. Through the upper part of the box an armoured flexible cord extends, the other end of which is fastened to the head-piece. This head-piece is similar in construction to the reflector of the watchman's lamp, and consists of an incandescent lamp, a reflector, safety shells, a safety glass, a crystal, and a switch. The battery is of the same construction as that of the watchman's lamp.

The weight of the lamp complete is $3\frac{1}{4}$ lb., and of the battery only $1\frac{1}{4}$ lb.

It is claimed that the storage-batteries are easily and quickly handled in charging, easy to take apart and repair when necessary, and quickly accessible. The sediment that tends to loosen from the positive plate still remains part of the plate. Jarring or upsetting the battery will not affect the plates as in batteries having thin vertical plates. Short-circuiting the battery will not injure the plates. The battery will not upon short-circuit arc sufficiently to ignite gas, black powder, &c. Immediately on short-circuit the voltage drops to zero, on account of the peculiar characteristics of the battery plates.

The solidified electrolyte always remains in contact with the plates, whether upside down or not, and when in any position will not ruin a man's clothes by the spilling of acid. The batteries will give an average light of 5 C.P. for 12 hours or more on each charge.

If the crystal and safety-glass should get broken in an explosive atmosphere, the lamp is extinguished by the safety-glass opening the circuit at the switch and thereby eliminating the risk of igniting anything explosive on account of breakage of the lamp-bulb. The lamp becomes extinguished before the bulb breaks.

The arrangement of the three shells in the reflector or headpiece will prevent any danger from the bulb igniting anything explosive if the shells should be crushed or punctured, as the shells short-circuit the lamp and the light is extinguished before the bulb is broken.

Board of Trade Inquiries.—The Board of Trade Commercial Intelligence Branch has received applications from firms in this country for makers of 2 to 30-H.P. electric motors (various voltages, D.C. and A.C.) to drive ventilating fans.

LEGAL.

Electric Generator Co. *v.* Jackson.

On February 10th, in the West London County Court, before his Honour Sir W. Lucius Selfe, plaintiffs, electrical contractors, of Shepherd's Bush Road, W., sued defendant, an electrical engineer, of Fulham Road, S.W., for £17 15s., the price of an electric motor and starter which the defendant had hired and had retained.

After hearing the evidence, his Honour said that, allowing defendant credit for half of the first quarter's hire, he would give judgment for the plaintiffs for £10 3s. and costs, payable in two monthly instalments.

Herbert Morris, Ltd., *v.* Saxelby.

As briefly mentioned last week, the House of Lords, on Feb. 8th, gave their considered judgment in the appeal by Messrs. Herbert Morris, Ltd., against an order of the Court of Appeal affirming a judgment of Mr. Justice Sargant in favour of the respondent, Mr. Fred. Albert Saxelby. The arguments were concluded on November 29th last. Their Lordships decided that the decision appealed from was right, and dismissed the appeal with costs.

Lord Atkinson, in the course of his judgment, said that the action out of which the appeal arose was brought to restrain the respondent (1) from being concerned in the sale or manufacture of pulley blocks, hand overhead runaways, electric overhead runaways, hand overhead travelling cranes, or any part thereof, and (2) from divulging or using confidential information acquired by him whilst in their employ. In all these cases one had to ask oneself what were the interests of the employer that were to be protected, and against what was he entitled to have them protected? He was undoubtedly entitled to have his interests in his trade secrets protected, such as secret processes of manufacture, which might be of vast value; and that protection might be secured by restraining the employé from divulging these secrets or putting them to his own use. He was also entitled not to have his old customers by solicitation or such other means enticed away from him; but freedom from all competition *per se* apart from both these things, however lucrative it might be to him, he was not entitled to be protected against. He must be prepared to encounter that even at the hands of a former employé.

Turning to the facts to ascertain what in fact it was that the appellants here sought protection against, his Lordship mentioned that the plaintiffs were very successful manufacturers of the particular class of machinery he had referred to. They had specialised in it—standardising many parts common to different types of machinery. Though they made some other machinery, this kind constituted three-fourths of their output. In this manufacture they appeared to be the premier firm in England. Their business was very extensive. They had branch offices at London, Manchester, Birmingham, Leeds, Sheffield, Newcastle, Cardiff and Glasgow. They had a traveller in Ireland but no office. Their regular and apparently principal customers, as appeared from the evidence of their managing director, Mr. H. Morris, were the Admiralty, the War Office, the Government Ordnance Factory, numerous foreign and Colonial Governments, railway companies both at home and abroad, and more recently the Aircraft Department and the torpedo factories. No other customers were named. There was nothing to show that Mr. Saxelby ever came into personal relations with any of the officers of these departments or undertakings, or that through his acquaintance or personal influence with any of them he might be able to divert their custom away from the plaintiffs to another firm. In his opinion there was no danger whatever of anything of that kind, and the question of enticing away of customers might be put aside. The appellants, moreover, had thoroughly organised their business, both on the manufacturing and commercial side of it. They had got up and arranged in an elaborate, careful and systematic manner, a large number of charts and drawings called L sheets, comprising tables and indicating the composition and dimensions suitable for particular jobs. Mr. Justice Sargant found that the information there contained was so detailed and minute that it would be impossible for any employé to carry it away in his head. It was claimed, however, by the appellants, that this organisation and general method of business were trade secrets which the defendant was not entitled to divulge to another, or to use his knowledge of them in the service of any persons other than themselves; but he could not get rid of the impressions left upon his mind by his experience on the plaintiffs' works. They were part of himself, and in his Lordship's view he violated no obligation arising from the relation in which he stood to the appellants by using in the service of some person other than they, the knowledge he had acquired of their scheme of organisation and methods of business. Up to the time that the respondent left the service of the appellants in 1913, his whole engineering training was connected with the manufacture of these four special machines. He said he had tried to get employment as a general engineer and had failed, and he was therefore obliged, being unable to live in France, to take service with one of the appellants' rivals.

His Lordship agreed with the view of the Court of Appeal that although the agreement might be of some advantage to the plaintiffs as restraining competition, yet it was not reasonable when viewed from the point of view of the defendant or of the public in general. It was not reasonable to require the defendant to put aside all the skill and experience that he had acquired during the period that he had been in the plaintiffs' employment and to begin life afresh. Accordingly the appeal must be dismissed with costs.

Lord Shaw's judgment, which was read in his absence by Lord Atkinson, was to the same effect. He said that Mr. Morris, the managing director of the plaintiff company, very candidly admitted that the real object of the plaintiff company in imposing the restraint was to preclude competition on behalf of the defendant after he had left the company's employment. The company objected, he said, to skill and knowledge acquired in its service being put to the disposal of any trade rival, and the skill and knowledge he referred to was the general skill and knowledge which an employé of any ability must necessarily obtain as opposed to knowledge of any matter and skill in any process in which the company could be said to have any property at all. He was clearly of opinion that the restraint was in no way required for the plaintiffs' protection, and was therefore unreasonable and bad in law.

Lord Parker of Waddington, in concurring, pointed out that it had been laid down that all restraints on trade of themselves, if there was nothing more, were contrary to public policy, and therefore void. It was not that such restraints must of themselves necessarily operate to the public injury, but that it was against the policy of common law to enforce them, except in cases where there were special circumstances to justify them. The test, he thought, was this: that for the restraint to be reasonable in the interest of the parties it must afford no more than adequate protection to the party in whose favour it was imposed. He agreed that the appeal failed.

In this judgment Lord Sumner expressed his entire concurrence.

The appeal was accordingly dismissed, with costs.

Munitions Court Cases.

At the Edinburgh Munitions Tribunal, William Cowie, employed in driving an electric crane for Messrs. Redpath, Brown & Co., Albion Road Steel Works, applied for a clearance certificate on the ground that the work he was engaged on was dangerous. A representative of the firm stated it was an overhead electric crane that Cowie was engaged on and it was a perfectly simple job. The Tribunal refused to grant the certificate, the Chairman advising Cowie to give the work a fair trial.

In a case before the Oldham Tribunal, a labourer employed by a firm of electrical engineers applied for a leaving certificate on the ground that his wages were too small and he had another job offered him. He received 23s. for working 53 hours, and had a wife and children. He now had 30s. offered to do other work in a mill. The firm said the man's average wages during the past four weeks had been £1 8s. 3d. The application was refused, the President holding that the man was fully employed on munitions.

Before Sir Robert Wallace, K.C., sitting at the London and S.E. Division General Munitions Tribunal, a well-known firm of electrical instrument manufacturers were the complainants, and a firm of builders and contractors were the respondents. The Chairman said that the plaintiffs' workmen were clearly engaged in war work, that a number of them left without the consent of their employers, that they had not obtained from the legal tribunal a certificate of discharge, and that they had all been taken into the employment of the respondents. An offence had been committed. The Chairman said that, having heard all the witnesses called by the respondents and the men, they did not want to hear any evidence on behalf of the complainants. In regard to four of the men, the offences against the Act were deliberate and not done in ignorance, for it had been admitted by respondents' manager that when the first man applied for work questions were asked, and the manager was informed that no leaving certificates had been obtained, also that the men had been engaged on war work. A former employé of the complainants was the medium through whom the men were engaged. The Chairman described it as a very bad case indeed, and fined the respondents £15 in each case, and granted 10 guineas costs.

Re Bryant Trading Syndicate, Ltd.

A curious story was told to Mr. Justice Neville in the Companies' (Winding Up) Court, on Tuesday, February 15th, when Mr. Wm. East, a retired brewer living at Wimbledon, applied under Sec. 32 of the Companies' Act, to have his name removed from the register of shareholders in the Bryant Trading Syndicate, Ltd.

Mr. Preston (for the applicant) said the Bryant Trading Syndicate, Ltd., was now in liquidation, and it was alleged that his client was the holder of 50 £ shares, with only £1 paid. Under these circumstances, he made this application, and his case was that the company had no business, and never had any business, to put his name on the register. Mr. East was apparently interested in electric lamps, and in 1908 he heard from a friend that this company was producing a very good lamp. On that account he went with his friend to see it. Apparently there were none for him to see. But he paid £1 for lamps to be sent to his residence that he might test them. He was invited to take shares in the company, and was, indeed, induced to sign an application for 50 shares. But Mr. East stipulated that this application was not to be used until he had tested the lamps. In fact, no lamps were ever sent to him, although he wrote to the company two or three times. Upon that he dismissed the matter from his mind. No notice of allotment was ever sent to him, and until the company went into liquidation, and this demand was made upon him, he only received one communication from the company. That was about four years ago, and as it seemed to indicate that he was being treated as a shareholder, he wrote to the company saying that he was no such thing, and the communication must have been sent to him in error. Apparently there was a resolu-

tion on April 9th, 1908, allotting the 50 shares. He submitted (1) that Mr. East's application was subject to a condition that had never been satisfied; (2) that even if there had been an unconditional application, the company never communicated the fact of the allotment to Mr. East.

Mr. Walter East went into the witness box to be cross-examined by Mr. Hewitt, K.C., for the liquidator of the company upon the affidavit he had made. He said that when he went to the office of the Bryant Trading Co. in April, 1908, he did not intend to subscribe for shares. But the managing director, Mr. Metcalfe, whose "Geese were all Swans," asked him to take up 500 shares and "practically compelled him" to apply for 50. He said he would not touch them unless the test was satisfactory. But Mr. Metcalfe said the shares were going so fast that he could not guarantee that they would be allotted if the application were deferred, and he made a conditional application accordingly. After the non-delivery of the lamps he did nothing to secure the repayment of his sovereign.

Mr. W. F. Moore, secretary and sales manager of the company from 1908 until 1911, said that he remembered the shares being allotted to Mr. East, but could not remember the notice of allotment being sent out in this particular case. He had no doubt the notice of allotment was sent out.

Mr. James, secretary of the company from 1911 to 1915, said that he first sent out notices to shareholders who had not paid for their shares in full in 1911. About two a year would be sent out afterwards asking for the unpaid balance on the shares. He could not remember any shareholder writing back to deny his liability.

Mr. Hewitt submitted that the memory of Mr. East was not to be relied upon, and that there was ample evidence to show that he had, or should have had, the presence of his name on the register of shareholders brought home to him.

His Lordship, in giving judgment, said this was rather a curious case, which had arisen owing to a peculiarity in the management of a company which he had never come across before, and which he should recommend other companies not to follow, *i.e.*, the company never made any calls on their shares, but occasionally applied to shareholders for something on account of the value of the shares they had taken. Of course they had no right in any of these cases to demand anything from the shareholders, because the liability of shareholders was dependent on the making of calls in the first instance. The question turned on an interview of April 8th, 1908. With regard to that he was not satisfied that Mr. East's application was conditional upon a test of the lamps. Moreover, he had, if he had chosen to read it, received notice over and over again, that he was on the register of shareholders in the company. He was sorry for Mr. East, but saw no reason to rectify the register. The summons would be dismissed, but without costs, because the trouble had been caused by the way in which the company had acted in making no calls, but merely writing round for subscriptions.

Electrical Controller Fingers.

An action by Messrs. Allen West & Co., Ltd., of Lewes Road, Brighton, against the British Westinghouse Electric and Manufacturing Co., Ltd., of Norfolk Street, Strand, claiming an injunction for alleged infringement of a registered design was heard by Mr. Justice Astbury in the Chancery Division on Thursday, February 10th. Plaintiffs said they were the registered proprietors of the copyright in a design of controller fingers for electrical machinery, and the defendants had without their licence or written consent infringed the copyright, and as an instance of the infringement the plaintiffs referred to the supplying by the defendants to the Admiralty of controller fingers for use on machinery installed in a boiler shop in Portsmouth Dockyard in the latter part of 1914 or the beginning of 1915. Defendants denied the alleged infringement, and said the design was invalid, and it was not new or original at the date of registration. They pleaded prior publication and prior general common knowledge. They said the design had been published in this country prior to the plaintiffs' registration by the publication of a drawing by Robert Friedrich Baerlocker, of the Westinghouse Works, Trafford Park, defendants' engineer, in 1909, and by the publication of the drawing by the defendants to their workmen in the ordinary course of their trading between March, 1909, and March, 1910. Defendants also said the design of the plaintiffs had been anticipated by the manufacture and sale by the defendants to the Cargo Fleet Iron Co., Middlesbrough, in 1910, of 17 controllers with controller fingers. Defendants had a motion to expunge the plaintiffs' design from the register of designs.

Mr. Colefax, K.C., and Mr. C. Terrell appeared for the plaintiffs, and Mr. Walter, K.C., and Mr. J. H. Gray for the defendants.

His Lordship gave judgment, and said the encouragement given by the patent laws to new conditions and original designs was primarily to advance our industries and to keep them at a high level, but in administering the provisions of the laws, it was most important to bear in mind that they were not intended, and should not be allowed, to paralyse or impede the natural growth and development of manufactures which they were intended to benefit. He thought that the present case rested upon the question whether the difference in the registered design of the right-angled support finger was or was not sufficient to make it an original design within the meaning of the Act, or whether, on the contrary, it was not an ordinary and natural alteration of the shape of a known article for the purpose of fitting it into a case or apparatus in which it was desired that it should work. He thought that the pattern of the finger in the anticipation could, if it was reasonably adjusted, be made to fit into a space as small for all practical purposes as the finger shown in the original design. The alteration was not sufficient subject matter for a registered design, and the design in question was therefore not valid, and there must be judgment for the defendants in the action and motion, with costs.

A stay of execution was granted on the application of Mr. Terrell.

Price *v.* Hammersmith Borough Council.

In the King's Bench Division, on Monday, February 14th, Mr. Justice Rowlatt gave judgment in a case that had occupied his attention for some days, in which the plaintiff, Mr. Edward Price, proprietor of the Royal Laundry, Goldhawk Road, Shepherd's Bush, W., sued the Hammersmith Borough Council to recover compensation in respect of a fire that occurred on his premises through, as he contended, the fault of the defendants' electrical installation. The defendants denied liability. After hearing the evidence, Mr. Justice Rowlatt said that in this case the plaintiff sought to recover damages in respect of a fire that broke out in a laundry, and the defendants were sued as a public corporation which supplied the laundry with electricity. It appeared that the fire broke out in the sorting room of the laundry where the service main—which belonged to the defendants and for which they were responsible—entered the fuse-box and meters, which were connected at a point where the plaintiff's own wires began, and for which the defendants were not responsible. The first question was whether the fire broke out in the service main belonging to the defendants on the defendants' side of the fuse-box? On that question, and on that alone, he had been addressed by counsel.

His Lordship concluded his judgment as follows:—"I think it has not been made out that the plaintiff's fire commenced in the defendants' service mains. I do not think that the plaintiff has proved his case. It is a fire which must remain, in my judgment, one of unknown and mysterious origin. It has not been shown to me how it happened. I know quite well where there is apparently no external cause of a fire, and there is electricity in the place, and the service main is found to be burned, that one is apt to say that it must have been the electrical current which started this; but this is only guessing, and I do not think that I am entitled to adopt that intellectual process. The plaintiff has not reasonably convinced me by the evidence that this fire was caused by the electrical main, and I cannot say how the fire began. Under these circumstances, the onus is on the plaintiff, and I must say that he has not proved his case, and, therefore, there must be judgment for the defendants, with costs."

Sub-station Attendants.

In our report of this case on page 170 last week, Mr. Bowden was incorrectly represented as saying that "no special skill was required" for the work in question; the word "no" should have been omitted.

As we go to press, the following has come to hand from Mr. W. Arthur Jones (president of the Association of Electrical Station Engineers), on behalf of the Executive Committee of the Association:—

Referring to your report in last week's issue of the case before the London Munitions Tribunal between Mr. J. H. Bowden, chief engineer of Poplar, and Mr. W. J. Ebben, in which it is stated that a certificate of release was refused, it is only fair to Mr. Ebben to state that the finding of the Tribunal was that—"In view of the facts that Mr. Bowden has now promised to release Mr. Ebben as soon as the improver referred to becomes more proficient, and that overtime would be arranged on munition work, a certificate could not be granted."

We may state that this Association was mentioned by Mr. Bowden in connection with this case, and we would emphatically point out that it was purely a personal matter relating to Mr. Ebben.

As an Association we take great exception to the statement that Mr. Bowden is reputed to have made "that no special skill was required for the class of work referred to." We think that as it was necessary for Mr. Bowden to enlist the services of two of his chief assistants, and also that of Mr. Beauchamp, Chief Engineer of West Ham, at the tribunal to retain the services of Mr. Ebben, the statement to which we take exception is somewhat disproved.

Coal Mines Act Prosecution.

Sheriff Hay Shennan, Hamilton, has given judgment in the case reported in our last issue.

His Lordship finds, in regard to Hutchison, that so far as the cable was concerned, no blame attached to him, and that the course he adopted was not dangerous so long as the workmen observed reasonable precautions. The evidence showed that a course similar to that which Hutchison had taken was frequently followed in the district, and had hitherto led to no mishap if ordinary caution was observed. The plan adopted was to clear away the *débris* from the side of the road furthest away from the cable. As this was done, the soft material kept falling away towards that side, and by the time the men came very near the cable, it should have been possible to lift it by hand and replace it, so as to hang it on the side of the road. Hutchison warned the men that the current was on, so that they might exercise caution. That could not be urged against him as proving that there was danger. There were many unavoidable dangers in coal mining, and it was part of the duty of a careful fireman to keep on warning the men to be cautious. The Sheriff, however, considered that Hutchison, through a misunderstanding of his duty, had failed to comply with the statutory requirement

in regard to the state of the roof where the fall took place. He ought to have mentioned in his report that the roof was defective there. His Lordship therefore found this part of the charge proved, but dismissed the respondent with an admonition. From the evidence led, he found the charges against Shaw—which had also reference to the cable—not proven.

WORKMEN'S COMPENSATION.

SHERIFF MOFFATT, Falkirk, on Friday issued judgment in an action raised under the Workmen's Compensation Act by the Scottish Central Electric Power Co. against Wm. Kerr, labourer. While in the employment of the company Kerr met with an accident involving injuries to his head and back, and was paid compensation at the rate of 12s. per week. In consequence of an arrangement, Kerr accepted employment from the Scottish Central Electric Power Co. at his old rate of wages in lieu of further compensation. Proceedings were raised by the company to have it declared that his incapacity had ceased, or at least diminished, and they asked the Court to review the weekly payment of 12s. and to end or diminish the same. Kerr objected to the proceedings, maintaining that, as he had not recovered from the effects of his injuries, no order should be pronounced terminating his right to receive compensation. The Sheriff found in favour of the workman and dismissed the proceedings, finding the employers liable in expenses on the higher scale.

A BELFAST ACTION.

MR. JUSTICE GIBSON, in the King's Bench Division, Dublin, directed notice to be served on defendant's solicitors in reference to an application, on behalf of plaintiff, to have interrogatories administered in the action by Mr. A. B. Farrell, resident superintendent of the central electricity works, Belfast, against Mr. T. W. Bloxam, city electrical engineer, Belfast, for alleged slander, the words complained of dealing with the support and clamping of main feeder cables and with plaintiff's methods of work. The object of the application, it was explained, was to enable defendant to specify the cables, &c. Plaintiff's solicitor had already sent the proposed interrogatories, wishing to avoid application to the Court, but no reply had been received, except that counsel's advice was being sought.

BUSINESS NOTES.

Consular Notes.—JAPAN.—H.M. Consul-General at Kobé (Mr. R. G. E. Forster) reports that one result of the war will be to stimulate the industries of Osaka, the main part of whose foreign trade is done by Kobé. Industries, which were being slowly worked up against the competition of the imported articles, have suddenly been given a free field. To how great an extent they will profit by the occasion to establish themselves firmly against the time when they have again to face competition remains to be seen, but it seems clear that after the war importers of manufactured goods will be faced with greater difficulties than formerly. As to the effect on British trade, it is difficult to speak. The elimination of German and Austro-Hungarian competition would appear at first sight to afford a splendid opportunity, but as far as can be seen at present manufacturers and merchants in the United Kingdom have their hands too full to capture new trade. For the present, therefore, it is rather a question of how much of the old trade in machinery and metals, for instance, can be maintained.

The war has revolutionised zinc refining in Japan. Hitherto the two refining concerns at Amagaski, near Osaka, and Miike, in Kyushin, have been slowly feeling their way. As a result of the war great activity has been shown in connection with military requirements, considerable extensions have been made, and it is anticipated that when all the works contemplated are in working order they will be in a position to deal with the whole of Japan's output of zinc ore. There was a decline in imports of machinery from £1,697,000 in 1913 to £1,342,000 in 1914. All classes of machinery shared in this decrease, which, speaking generally, was due at first to the Government policy of retrenchment, combined with the general depression, and latterly to the difficulty of obtaining supplies from Europe. The making of machinery in Osaka and Japan generally is increasing yearly. To give a few instances, the demand for oil and gas engines is met largely by locally-made engines; while in machine pumps, water turbines, cranes, dynamos, motors, locomotives, and in many other classes of machinery, imports are feeling the effect of local competition. Since the outbreak of war the difficulty which British firms have experienced in accepting orders for prompt delivery has diverted many orders which might have been expected to go to the United Kingdom.

Bankruptcy Proceedings.—J. TAYLOR PEDDIE, described as an engineer, of Aldwych Site, Strand, W.C.—An application was made, last week, to Mr. Registrar Linklater, at the London Bankruptcy Court, for approval to a scheme of arrangement recently entertained by the creditors. Mr. Egerton S. Grey, Official Receiver, reported that proofs of debt amounting to £9,744 had been lodged, and the proposal provided for the payment of a composition of 5s. in the £ on claims of £2,748, and for the absolute release and discharge of liabilities to the amount of £7,472. The Official Receiver opposed the application on the grounds (1) that it was not the actual arrangement which debtor was seeking to make with his creditors; (2) that the assets were not equal in value to 10s. in the £ on the amount of the liabilities; and (3) that he had brought on his insolvency by rash and hazardous speculations. Mr. E. W. Hansell, who appeared in support of the application, pointed out that although the releasing creditors represented the majority in value of the debts, they were only a few in number, and were confined to Stock Exchange claims in respect of differences, whilst the creditors who were to receive the composition were 21 in number. His Honour, after hearing evidence, approved the scheme of arrangement, and annulled the order of adjudication.

ALFRED SLATTER, consulting electrical engineer, Caxton House, Westminster, S.W.—An application for an order of discharge was made, on February 8th, to Mr. Registrar Linklater, at the London Bankruptcy Court. Mr. Egerton S. Grey, Official Receiver, reported that the applicant failed in June, 1912, with provable claims £2,380, and assets valued at £198, but only £10 had been received in respect of the estate. The only offence reported by the Official Receiver was the insufficiency of assets to equal in value 10s. in the £ on the amount of the unsecured liabilities, and his Honour granted a discharge, subject to a nominal suspension of three weeks. Order entered accordingly.

G. E. BONNER, Ashcroft, 103, Fox Lane, Palmer's Green, Middlesex, electrical engineer.—The first meeting of creditors was fixed to be held on February 11th, at 14, Bedford Row, W.C., when the statement of affairs showed liabilities amounting to £210, and assets estimated to realise £63; after deducting preferential claims, the estate disclosed a deficiency of £147. The debtor prior to November, 1914, had for 17 years been engaged as stockbroker's clerk, but on the outbreak of war his salary was considerably reduced, and he took up an agency with a firm of electric lamp manufacturers on commission terms, but did very little business. In November, 1914, the stockbrokers terminated his employment, and from that time until last December his only employment was the agency for the lamp firm. Debtor stated that his failure was due to loss of employment and heavy interest to money-lenders. The matter remains in the hands of the Official Receiver.

Book Notices. — *Sell's Directory of Telegraphic Addresses.* London: Business Directories, Ltd. Price 25s.—The 1916 edition of this useful business directory has just appeared. In the course of its 2,600 pages it gives an alphabetical list of firms in London and the country, with their telegraphic addresses and telephone numbers; an index to telegraphic addresses; a classified trades list of the United Kingdom; cable addresses of British Empire overseas and foreign firms; telegraph tariffs, and other information. All new telegraphic addresses and alterations in postal addresses received from the Postmaster-General up to January 1st this year are included. The classified trades list contains more than 3,400 separate trade headings.

"*Journal* of the Institution of Electrical Engineers." Vol. LIV. No. 256. February 15th, 1916.—This issue contains a paper on "The Principles of Modern Printing Telegraphy," by Mr. H. H. Harrison. There is also a "Sixth List" of 65 members of the Institution serving with H.M. Forces.

"The *Practical Engineer* Electrical Pocket Book and Diary for 1916." London: The Technical Publishing Co. Price, cloth, 1s. 4d., post free. The new edition has been brought up to date, especially in connection with the specifications for copper conductors, particulars of instruments and apparatus, electric furnaces, and standards for electrical machinery; and new sections have been added relating to telephones and to first aid in case of accident. It contains a remarkably varied and comprehensive amount of information.

"Science Abstracts." Sections A and B. Vol. XIX. Part I. January 31st, 1916. Index to Vol. XVIII. Sections A and B. London: E. & F. Spon. Price 1s. 6d. each net.

"Lockwood's Builder's and Contractor's Price Book for 1916." London: Crosby Lockwood & Son. Price 4s.

"Telegraph Engineering." By E. Hausmann. London: Constable & Co., Ltd. Price 12s. 6d. net.

"The Universe and the Atom." By M. Erwin. London: Constable & Co., Ltd. Price 8s. 6d. net.

"Directory of British Manufacturers for Russian Trade." London: Russo-British Trade Exchange, Ltd. Price 5s.—This directory, which has been edited by Mr. R. A. Lenski, is printed in the Russian language for circulation in Russia. It consists of 400 pages, with trade headings in Russian and English. It has received the support of representative electrical manufacturers, whose advertisements are suitably illustrated and are well produced. We hope it will prove of some assistance to our firms who are trying to gain a hold on the Russian market.

Trade Announcements.—THE ELECTRICAL SUPPLIES Co. are opening a Manchester office and stores at 40, Victoria Buildings, Victoria Street, Manchester (Telephone No.: "City 5794"). Mr. R. L. Bateson has been appointed manager of the branch, where stocks of lamps, cables, fittings, carbons and accessories will be held.

THE HOLMQUIST ELECTRIC CO., 1911, LTD., and the RADIO ELECTRIC LAMP CO., LTD., have removed to more commodious premises at 17, Great Chapel Street, Oxford Street, W. Telephone: "4278 Regent."

MESSRS. CAVE & HIGGIN, LTD., of 265, Deansgate, Manchester, have altered their title to HIGGIN, LTD., and all communications should be so addressed.

Liquidations.—Oil-Flame Furnace Co., Ltd.—A meeting will be held at 11, Ironmonger Lane, E.C., on March 14th, to hear an account of the winding up from the liquidator.

Globe Electric Co., Ltd.—Creditors should send the usual particulars to Mr. G. E. Corfield, 119, Finsbury Pavement, E.C., the liquidator, by March 14th.

Patent Restoration.—The Adjustable Cover and Boiler Block Co., Ltd, has applied for the restoration of Patent No. 6,831, of 1911, granted to J. R Hannam, for "Improvements in or relating to side flues and downtakes for boilers."

LIGHTING AND POWER NOTES.

Accrington.—Plant Extensions.—The Electricity and Health Committees have given instructions for a scheme to be prepared and tenders to be obtained for dealing at the minimum of cost with the present difficulties at the destructor and electricity works. The proposal includes the erection of a new chimney and flues and the provision of a new tubular boiler for the destructor, thus releasing two Lancashire boilers for the electricity works. The scheme is estimated to cost between £5,000 and £6,000.

Australia.—Although the Fremantle (W.A.) Council recently decided to reject the Government's offer to supply electricity in bulk from the Perth power station, it is understood that the Fremantle Tramway Board has decided to accept the offer, which includes delivery of energy at the Board's main sub-station at East Fremantle, at '85d. per unit. The agreement is proposed for 50 years; electricity may be resold to other local authorities at not more than 2d. a unit and to the Government at not more than 1¾d. per unit. The Tramway Board was influenced in its decision by an expert report by Mr. Curle Smith, showing a profit margin in favour of the Government supply.—*West Australian.*

Mr. Forbes Mackay, reporting on the delay in supplying North Sydney (N.S.W.) with electricity, pointed out that this supply could be available in 10 days after receiving the submarine cables to cross the harbour. It is understood that the cables have been shipped, and it is hoped that the supply will be ready by the end of the month.

Barnes.—The contract for the maintenance of the storage battery having expired, the Tudor Accumulator Co. has asked for a renewal for a further period of 10 years on the same conditions, but no security would be deposited. The matter was adjourned until the next meeting.

It was decided to make arrangements for a supply of electricity to the houses on the Vine Cottage estate as soon as they are ready for occupation.

Bradford.—A small Sub-Committee of the Guardians has been deputed to consider the installation of electricity at the Bowling Park Colony.

Bridlington.—Destructor Scheme.—The L.G.B. has disapproved of the Corporation's scheme for the erection of a refuse destructor at the electricity works.

Brighton.—Suggested Price Increase.—The Electricity Committee has decided to adhere to the proposal to raise the maximum price of electricity to 5½d. per unit, with reductions after the first 1,000 units, but suggests that the charge for power should be raised ½d. per unit on the first 2,000 units. Consumers outside the borough are to be charged 6½d. per unit. It is also proposed for the improvement of the financial position of the electricity undertaking, to transfer to rate account certain annual liabilities on capital expended in plant for street lighting in unremunerative areas.

Chester.—The Waterworks Co. has under consideration the substitution of electric power for steam with a view to reducing the working expenses.

Church Stretton.—Prov. Order.—The local Electricity Co. has applied for a provisional order in respect of the urban district of Church Stretton and the parishes of All Stretton and Little Stretton.

Continental.—Spain.—A joint stock electric supply company, styled the Energica Electrica de Asturias, is being formed at Ujo, in the Province of Asturias. It is intended to utilise certain waterfalls on the Aller River, totalling 6,000 H.P. The scheme is in the hands of the engineer Don Juan Rovira.

Russia.—When the new Moscow central station was constructed in 1898 a three-phase 2,100-volt distribution system was adopted, with transformer pillars where the pressure was stepped down to 120 volts. In 1907 the network was extended to the industrial districts beyond the city, and in 1910 the distribution pressure was increased to 6,500 volts, there being at the present time two 6,500-volt networks and four 2,100-volt networks. Last year the central station and cable network were further modified, with a view to increasing their efficiency.

Dublin.—The report of Mr. P. W. d'Alton, on the Corporation's electricity undertaking, indicates that the administration of the system is unduly complicated owing to the dual control by an engineer who is not a manager, and a secretary who in part manages. The engineer should be given more responsibility for the number and qualifications of people employed, and for the extension of the load and its measurement. The charges for energy, while not unreasonable for public lighting, are unduly high for private supply. Considerable reductions in the number of workmen employed at the Pigeon House are possible. The wages paid under the Department of Public Lighting appear to be out of proportion, amounting to over 16 per cent. of the gross revenue received for that service. The cost of the secretarial department is high; a general gain in economy would follow were canvassers and meter-readers placed on the engineering staff. The salaries and wages paid otherwise than from revenue appear to be unduly heavy. The coal supply seems to have become a monopoly; methods should be adopted in the future to secure competition, and the coal specification issued by the Corporation should be more rigidly drawn. The charges for interest and repayment of moneys borrowed are fair, and are being admirably met. Further capital must be expended at the generating station to provide for the demands of the winter of 1917-18, and a scheme of extension must be prepared, and estimates invited and considered, during the coming year. During the spring and summer of 1916 no efforts must be spared by the engineering staff to get the power house into proper condition to meet its winter load with existing plant. The returns of the units generated at the power house are unreliable on account of the condition of the watt meters, which must be overhauled, repaired, and recalibrated before any reliance can be placed on their readings. The Stewart engines are obsolete and extravagant, and should only be worked in emergency. The Belliss-Morcom engine wants a thorough overhaul by its makers, to render it less extravagant in steam consumption; such an overhaul will probably greatly increase its efficiency. The Richardsons-Westgarth turbine should be in part reconstructed by the makers, to reduce its steam consumption. The Oerlikon turbines are excellent. The condensers of the station, which are now, and have for long been, seriously ineffective, must be put right. The older section of the boiler-house plant should be used only in emergency; it ought not to be worked as it is now on the daily load. The five large Babcock-Wilcox boilers and the Yarrow boiler should be always used for the day in, day out, needs of the station. Such a practice in connection with boilers and engines will produce a saving of the first importance in coal, labour and repairs. The present practice of using obsolete plant for the majority of the working hours of the station, and reserving modern and efficient machinery for intermittent peak and emergency loads, is to be deprecated as most extravagant.

The local Press publishes portions of counter-reports, prepared by Mr. Fred Allan, secretary to the Electricity Supply Committee, Mr. Mark Ruddle, city electrical engineer, and Mr. L. J. Kettle, deputy city electrical engineer. The whole matter will be considered at the next meeting of the Electricity Supply Committee.

The statement of accounts of the electricity undertaking for the year ended March 15th, 1915, shows that the total capital expenditure was £834,757; the total income was £105,440, as against £98,190 in 1914, and the debt charges amounted to £53,579, as against £46,069 in 1914, the surplus on the year being £1,417, as compared with £4,917 in 1914. Together with balances brought forward, the total surplus available was £10,291, from which £2,351 was placed to renewals. The total units sold were 9,519,545, as compared with 8,516,927 in 1914. The maximum demand was 7,486 KW., and the station plant capacity 12,000 KW.

Eccles.—Proposed Extensions.—With reference to the proposed electricity extensions mentioned in this column last week, it is stated that the present engine capacity at the generating station is fully loaded, and the Committee wishes to proceed with the extensions in order to use them as soon as the war is ended. Existing cables would be available for lighting purposes; the three-phase system is necessary for supplying energy to local works.

Ecuador.—The Municipality of Daule has been authorised to install an electrical plant for the public lighting of that town.

Edinburgh.—The Edinburgh Merchants' Association has passed a resolution condemning the Corporation's action in proceeding with the Portobello scheme at the present time.

Epsom.—Increased Prices.—Owing to the extra cost of coal, &c., the U.D.C. is recommended to increase the charges for current by 25 per cent., as from March 31st next. The assessment of the undertaking having been increased from £650 to £1,285, an appeal has been entered.

Glasgow.—War Economy.—Mr. Lackie reports that by deferring meter cleaning and repairs for an extra year £1,500 will be saved; also that £3,000 will be saved by delaying repairs to station plant.

Hastings.—Price Increase, &c.—The T.C. has been refused a loan of £500 for house services. The charges for electricity in respect of the current quarter have been increased by 10 per cent. as a temporary expedient, in addition to the 10 per cent. increase already in force.

India.—Dissatisfaction is felt in Calcutta at what are claimed to be the high prices charged for electricity to the general public, and the Corporation has adopted a resolution asking for an expert Government investigation of the matter. The public pays 8 annas and 4 annas respectively per unit for lighting and power; the Government pays less than half these rates for its supplies.

Ipswich.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of £3,100 for coal-hauling plant at the generating station.

Kilmarnock. — The Corporation electrical engineer reports that he has adjusted the terms of an agreement with the Caprington and Auchlochan Collieries, Ltd., for the supply of electricity to Annandale Pit, and that he proposed to run a new 11,000-volt transmission line from the works to the colliery, which could afterwards form part of the scheme for duplicating the supply to Troon and Irvine.

Lincoln.—The T.C. has decided to give an additional supply of current to Messrs. Clayton & Shuttleworth, Ltd.

Llanelly.—STREET LIGHTING.—The Electric Light and Traction Co. has made a rebate of £100 on the account of the T.C. in respect of restricted public lighting. The Council originally demanded a reduction of over £200.

London.—HAMPSTEAD.—The Lighting Committee has considered a report of the chief electrical engineer, with reference to the breakdown of the 1,000-KW. Westinghouse turbo-alternator on December 15th; the Committee found that the switchboard was of an obsolete pattern and incapable of dealing with the present loads, and it has authorised the engineer to issue specifications and obtain tenders for a modern switchboard. The B.C. has agreed to apply to the L.C.C. for sanction to the borrowing of £4,000 for the above purpose.

FULHAM.—After the current quarter the prices for electricity for private lighting, power and public lighting are to be increased to 4d., 1½d. and 1½d. per unit respectively, with no discount.

SHOREDITCH.—As from the March meter readings the price of electricity for all purposes is to be increased by 15 per cent. Owing to the increased cost of coal, &c., there will probably be a deficiency of £4,000-£5,000 on the year's working.

STEPNEY.—The Finance Committee of the B.C. has approved an estimate of £19,000 for two new boilers; the Council has machinery sanctions representing £16,000 in hand, and it is proposed to interview the L.C.C. with a view to utilising this sum and borrowing a further £3,000.

HAMMERSMITH.—The electricity works are at present insured against fire and aircraft risks to the amount of £45,588; the Electricity Committee has authorised an extension of the policy against aircraft for a further £45,588, representing an insurance against fire of £45,588 and against aircraft of £91,177.

Sheerness.—The U.D.C. has agreed to the proposal of the Sheerness E.P. Co. to increase the charge for the supply of energy at the sewage works by 15 per cent.

Market Drayton.—The Salop C.C. has withdrawn its objections to the Electricity Co. erecting overhead lines, subject to the usual B. of T. regulations being complied with.

Masham.—The Council has intimated to the local company that no tender will be required for public lighting under present conditions.

Middlesbrough.—The Cleveland and Durham Power Co. has granted the T.C. further privileges respecting the maximum load taken, and the engineer reports that it is not now necessary to consider the question of bringing the battery up to date; he suggested that a gas engine plant be installed for emergency use, and this was agreed to. It was stated that the alterations would cost £1,000, and effect an annual saving of £500 or so, besides deferring for several years a further expenditure of some thousands. The engineer reported that, owing to the new arrangements, the services of a chief assistant would not now be required.

Monaghan. — STREET LIGHTING.—The Council has now given permission to a company to proceed with the erection of poles and wires for the introduction of public electric lighting.

Newport (Mon.).—LOAN SANCTIONS.—The L.G.B. has sanctioned the borrowing of £780 in respect of an electric substation at Mill Parade. The Board has also sanctioned the raising of £3,004 for mains and £500 for services, and has advised the Corporation that it has deducted £375 to be paid by the contractors in respect of the laying of cables from Pill sub-station. With regard to the proposed loan for the provision of power to the factory at Maesglas, the Board asks to be furnished with details showing how the revised estimate of £3,872 is made up.

Sheffield.—A recent issue of the *Sheffield Daily Telegraph* contained a reference to the phenomenal state of hustle which characterises the city electric supply department. It appears that the generating capacity of the department has been doubled since the war started, and is now being quadrupled. Our contemporary's pen-picture of the E.L. Committee running away from the "slow-going" Council, and of the efforts of chairman and manager to out-distance the Committee, depicts a refreshing atmosphere of alertness not usually associated with municipal control in peace time. We understand that the Council will shortly be called on to sanction a further £137,000 expenditure on electricity extensions.

Stafford.—PROPOSED LOAN.—The T.C. has decided to apply to the L.G.B. for sanction to the borrowing of £12,000 for extensions to the electricity works.

Tasmania.—HYDRO-ELECTRIC WORKS.—Mr. Butters, the chief engineer, has submitted an estimate of £48 750 as the probable cost of completing the hydro-electric works. The total cost of the works, including the above amount, is placed at £338 996, exclusive of submerged land at the Great Lake, estimated eventually to extend over 5,000 acres and to cost £7,000 and of the cost of extension to North West Bay. Mr. Parry's estimate of the total cost of the first part of the scheme was £295 572, and the excess is attributed partly to payments in excess of preliminary valuation to the Complex Ores Co. and partly to generally increased cost of plant. It is announced that as soon as the annual consumption for domestic lighting in Hobart reaches a million units the price will be reduced to 4d. per unit.

Wadebridge.—COTTAGE LIGHTING.—The Electric Supply Co. has under consideration a scheme to supply electric light to the tenants of small cottages, at a weekly rate, which will compare favourably with the cost of oil or other means of lighting.

Walsall.—MOTOR HIRE SCHEME.—The electrical engineer has been authorised to negotiate a working arrangement with motor manufacturers, whereby they will supply motors on a three or five years' hire-purchase basis, through the sales department, without the department incurring any financial liability.

TRAMWAY and RAILWAY NOTES.

Argentina.—The first section of the Metropolitan electric railway, under construction at Buenos Ayres, was inaugurated on December 1st. The concession holder is the Anglo-Argentine Co. Three new tunnels will shortly be constructed to connect with the section inaugurated. The working day is 20 hours, and a three to five-minutes' service is given. On the opening day 100,000 passengers were carried.—*Industria e Invenciones.*

Continental.—DENMARK.—At a recent meeting of the Danish Ingeniurforening, a discussion was initiated on the "Eventual introduction of electric driving on the boulevard tramways in Copenhagen and on the neighbouring tramway system."

SPAIN.—An application has been made by the Sociedad Minera y Metalurgica de Panarroya for a concession to construct and work a narrow-gauge electric railway between Conquidor and Puertollano.

SWITZERLAND.—The General Management and the Standing Committee of the Swiss Federal Railways have just submitted a report to the Council of Administration in regard to the projected conversion of the Erstfeld Bellinzona section of the St. Gothard railway. It is first pointed out that the three-phase system would be unsuitable for the purpose in view, whilst the advocates of the direct-current method base their contentions on experience with lighter trains and pressures far below 3,000 volts. The single-phase system, which is already employed on the Lötschberg railway, can now be recommended for adoption without reserve. No other electric railway system exists which can be placed on an equality in regard to the varied nature of the service, the number of locomotives, length of the track, and extent of services rendered, with that of the New York, New Haven and Hartford Railway. At the same time this railway is the first which from the system used has proved itself to be extensible at will and capable of being accommodated to all kinds of services. In the case of the Lötschberg railway the interruptions in working were attributed chiefly to the difficult circumstances under which the electrical equipment had to be provided. The report also discusses the problem of uniformity in the form of current and periodicity, which it is sought to attain in the distribution of energy throughout Switzerland. The Amsteg and Ritom power stations, which are proposed for the working of the Erstfeld-Bellinzona section, will be able to furnish energy not only for this section but also for the whole line from Lucerne to Chiasso, the conversion of which will not be long deferred.

Darlington.—The T.C. has agreed to certain increases of wages in the tramway department, which will entail extra expenditure amounting to £135 a year.

Dudley.—On Friday last, Timothy Parkes, the conductor concerned in the recent tramway accident, was charged with manslaughter at the Dudley Police Court, and committed to the next Worcestershire Assizes.

The inquest in connection with the second death resulting from the recent tramway accident, was resumed on Monday, the jury finding that Turner died as a result of the accidental overturning of the car, which was caused by the negligence of the conductor, Parkes; the jury added that they did not consider this culpable or criminal negligence and addressed certain recommendations to the tramway company.

Dundee.—Mr. Fisher, the tramway manager, has drawn attention to the necessity of renewing the overhead equipment in the centre of the city, which work will shortly be carried out by the electricity department.

Ecuador.—A decree has been published authorising the construction of a railway, with electric traction if convenient, between Quito and Esmeraldas. The line will pass, by preference, through the towns of Cayambe and Otavalo; the first section to be constructed will be from Quito to Ibarra. Should it be decided to employ electric traction, the erection of a power station would be undertaken at the same time.

Glasgow.—War Economy.—Mr. Dalrymple has reported that there will be no expenditure on capital account this year, and that owing to depleted staffs ordinary expenditure will be reduced, but the saving will be counterbalanced by increased wages and war allowances. The T.C. has decided to purchase Thornliebank Gas Works, and ground is to be given up for road widening, the Tramways Committee contributing £500 towards the price.

Hindley.—The U.D.C. has approved a draft agreement with the Wigan Corporation for the lowering of the road under the bridge at Wigan Road, Hindley, to allow of the passage of double-deck tramcars, subject to the surveyor endeavouring to get the lowering tailed out to make the gradient not more than 1 in 80.

Jarrow.—The Town Improvement Committee has decided to communicate with the Tramway Co. regarding the condition of the tramway track.

Luton.—Tramway Extension.—The T.C. has been recommended to make application to the B. of T. for an order prolonging the period for the completion of the remainder of the tramway track for another two years from August 11th next.

Loan Sanctions.—The L.G.B. has approved of the borrowing of sums amounting to £30,327 for electricity purposes, by the T.C.

North London Railway Electrification.—It is stated that the work of electrifying the North London Railway to Richmond will shortly be commenced, and that a much improved service will be the result.—*Pall Mall Gazette*

Southport.—It has been decided that horse haulage at the Corporation gas works shall be superseded by electric haulage in the near future; the rails already in use will be retained, and the Electricity Committee will supply the overhead equipment and the necessary vehicle.

West Lancashire.—The L. and Y. Railway Co. proposes to construct a light railway from the existing railway at Hightown round by Formby Point, rejoining the existing railway at Ainsdale, a distance of about six miles. The Light Railway Commissioners have been asked to issue an order authorising the work

TELEGRAPH and TELEPHONE NOTES.

Air Raids.—In order to keep the lines free for official messages on the occurrence of air raids, the Postmaster-General has issued an appeal to the public to use the telephone as little as possible on such occasions, and on no account to call up the police or other public officials.

Australia.—It is hoped that the new telephone rates, which came into force on December 10th, will bring in an additional revenue of £180,000 a year. Increases in the postal and telegraphic rates will be made this year, in order to avoid a repetition of the deficit of over £600,000.

Canada.—On Monday last telephonic communication was effected between Montreal and Vancouver, a distance of 2,300 miles. Montreal was also connected with San Francisco.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 8th. Electrical goods, for the Powell-Duffryn Steam Coal Co. Stores Manager, Aberaman offices.

March 11th. U.D.C. Electrical stores for 12 months. See "Official Notices" to-day.

Australia.—Sydney. May 1st. Two 300-kw. turbo-alternators, condensers, switchboard, &c., for the pumping station at Ryde, for the Metropolitan Board of Water Supply and Sewerage at Sydney.*

May 3rd. N.S.W. Railways and Tramways Department. One 2,500-kw. turbo-alternator, for Zara Street, Newcastle, power house. Specifications (20s.) from the Engineer's office, 61, Hunter Street, Sydney.*

Birkenhead.—March 6th. Corporation. Cable and two rotary converters with switchgear. See "Official Notices" February 1st.

Bolton.—March 2nd. Electricity Committee. Stores, including some electrical items. See "Official Notices" Feb. 11th.

Bootle.—February 23rd. Corporation. Stores, including lamps, meters, fuse boxes, &c. Electrical Engineer.

Dewsbury.—Electricity Department. Two second-hand 250 kw. generators or panels, oil separator, piping, cables, &c. See "Official Notices" February 11th.

Dublin.—March 1st. Battery materials for carriage lighting, for the G.N. Railway Co. (Ireland). See "Official Notices" to-day.

Dundee.—February 28th. Corporation. Stores for the Tramways Committee. Mr. P. Fisher, General Manager.

France.—Paris.—February 24th. The State Railway Service requires 3,500 copper rail-bonds of 400 mm². section, and 9,900 of 200 mm². section. Bureaux du Service Electrique (3e division), 72, Rue de Rome, Paris (8e), Tuesdays and Fridays, 3 to 5 p.m.

Keighley.—30-h.p. electric motor installation for pump driving, for the Fleece Mills Co., Ltd. See "Official Notices" to-day.

London.—Battersea.—February 21st. B.C. Stores for the Electricity Department. See "Official Notices" Feb. 4th.

New Zealand.—Dunedin.—May 17th. City Council. (1) Tramcar bodies; (2) electrical equipment. Plans, &c., from the Town Clerk, Dunedin.*

Plymouth.—March 2nd. Corporation. Converter with starter. See "Official Notices" to-day.

Pontypridd.—March 13th. U.D.C. Twelvemonths' supply of electrical stores for the Electric Light and Tramways Department. See "Official Notices" to-day.

Swansea.—March 6th. Education Committee. Electric lighting installation at Brynmill and Cwmbwrla Council Schools. See "Official Notices" to-day.

West Ham.—March 22nd. B. of G. Three months' supply of electric fittings. Clerk, Union Road, Leytonstone.

Specifications for the items marked * can be seen at the Board of Trade Commercial Intelligence Branch in London.

CLOSED.

Glasgow.—Tramways Committee.

Traction lamps.—General Electric Co., Ltd., and Edison & Swan Co.
Lighting conduit and fittings.—Simplex Conduits, Ltd.

Messrs. W. Lucy & Co. asked the Electricity Committee for an increase of 10 per cent. on their contract prices for the supply of c.i. branch boxes, in consequence of the phenomenal rise in the price of pig-iron and foundry coke. The engineer reported that the other contractors for similar material had not applied for any increase, and the Sub-committee agreed to recommend that the increase be not granted.

Hampstead.—B.C. British Thomson-Houston Co., Ltd., for H.T. switchboard, £3,886.

London.—St. Marylebone. B.C.

British Westinghouse Co., Ltd.—Spare armature for rotary converter, at £1,013.
Ferranti, Ltd.—200 prepayment meters.

Bermondsey.—The Electricity Committee has given instructions for existing contractors to be asked to continue their contracts for supplies for a further 12 months on the same terms. The Committee has accepted a tender of the Glenboig Union Fireclay Co., Ltd., for 3,000 firebricks and one ton of fireclay in bags, for £28; and it proposes to renew for a further period of 10 years, upon the same terms, the agreement with the Tudor Accumulator Co. for the maintenance of the battery.

Newport (Mon.).—The contract for the supply of cables having expired, the electrical engineer proposes for the present to order supplies as required.

Park Prewett.—The tender of Messrs. Hill, Upton and Co. has been accepted by the Hants County Council, at £2 599, for telephones, fire-alarms, tell-tale clocks and bells, at the Park Prewett Asylum. This firm has the contract for installing the electrical plant.

Slough.—Messrs. Chamberlain & Hookham, Ltd., have received the contract for electricity meters for this year.

Sunderland.—Tender accepted by Electricity Committee:—Willans & Robinson, Ltd., blading for Willans turbine.

Walsall.—Electricity Committee. Accepted tender: Bellis & Morcom, for a 3,750 kw. turbo-alternator (in place of one sold to the Government) for £13,227.

West Bromwich.—The tender of the New Conveyor Co. for extensions to the coal conveyor at the Council's electricity works has been accepted.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, February 18th. At 6 p.m. At Gt. George Street, Westminster, S.W. Annual General Meeting. Paper on "Chisels," by Mr. H. Fowler.

Greenock Electrical Society.—Friday, February 18th. At 7.45 p.m. At the Temperance Institute, 18, West Stewart Street. Paper on "Electro-Plating," by Mr. S. V. Thorp.

Royal Institution of Great Britain.—Friday, February 18th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Polarised Light and its Applications to Engineering," by Prof. E. G. Coker.

Institution of Electrical Engineers (Manchester Local Section).—Tuesday, February 22nd. At 7.30 p.m. At the Engineers' Club, 17, Albert Square. Paper on "Continuous-current Railway Motors," by Mr. E. V. Pannell.

(Birmingham Local Section).—Wednesday, February 23rd. At 7 p.m. At the University, Edmund Street. Kelvin Lecture on "Terrestrial Magnetism," by Dr. C. Chree, F.R.S.

Illuminating Engineering Society.—Tuesday, February 22nd. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on "Some Future Possibilities in the Design of Instruments for Measuring Illumination."

Liverpool Engineering Society.—Wednesday, February 23rd. At the Royal Institution, Colquitt Street. Paper on "Efficiency of Projectors and Reflectors," by Mr. H. T. Harrison.

Leeds Association of Engineers.—Thursday, February 24th. At 8 p.m. At 5, Park Lane. Paper on "Stamp Forgings," by Mr. B. Saunders.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, February 25th. At 7.30 p.m. At the Bolbec Hall, Newcastle-on-Tyne. General meeting.

Manchester Association of Engineers.—Saturday, February 26th. At the Grand Hotel, Aytoun Street. Paper on "Cast Steel as a Material of Construction," by Mr. E. F. Lange.

Battersea Polytechnic, Battersea, S.W.—Saturday, February 26th. At 7 p.m. Annual conversazione and inspection of students' work.

TRADE STATISTICS OF NEWFOUNDLAND.

The following figures, showing the imports into Newfoundland during 1913-14 of goods which are of interest to electrical contractors, are extracted from the recently-issued trade statistics. The figures for 1912-13 are added for purposes of comparison, and notes are given of any increases or decreases.

	1912-13. Dols.	1913-14. Dols.	Inc. or dec. Dols.
Belting.—			
From United Kingdom ...	4,000	5,000	+ 1,000
,, Canada	6,000	3,000	− 3,000
,, United States ...	11,000	12,000	+ 1,000
Total	21,000	20,000	− 1,000
Gutta-percha manufactures.—			
From United Kingdom ...	21,000	26,000	+ 5,000
,, Canada	48,000	46,000	− 2,000
,, United States ...	66,000	79,000	+ 13,000
Total	135,000	151,000	+ 16,000
Iron and steel railway bars and fittings.—			
From United Kingdom ...	—	1,000	+ 1,000
,, Canada	5,000	1,000	− 4,000
,, United States ...	3,000	2,000	− 1,000
,, Other countries ...	1,000	—	− 1,000
Total	9,000	4,000	− 5,000
Radiators, electric light material, etc.—			
From United Kingdom ...	31,000	4,000	− 27,000
,, Canada	8,000	8,000	—
,, United States ...	64,000	40,000	− 24,000
,, Germany	1,000	1,000	—
,, Other countries ...	1,000	1,000	—
Total	105,000	54,000	− 51,000
Machinery for mining purposes.—			
From United Kingdom ...	34,000	42,000	+ 8,000
,, Canada	267,000	140,000	− 127,000
,, United States ...	92,000	56,000	− 36,000
Total	393,000	238,000	− 155,000
Machinery for local industries.—			
From United Kingdom ...	3,000	2,000	− 1,000
,, Germany	4,000	3,000	− 1,000
,, Canada	2,000	1,000	− 1,000
,, United States ...	8,000	20,000	+ 12,000
*Total	17,000	26,000	+ 9,000

*Not including $53,000 value of material and machinery for pulp paper and saw mills, of which $38,000 came from the United States, $10,000 from Canada, and $4,000 from the United Kingdom.

	1912-13. Dols.	1913-14. Dols.	Inc. or dec. Dols.
Oils, lubricating.—			
From United Kingdom ...	2,000	3,000	+ 1,000
,, Canada	7,000	7,000	—
,, United States ...	21,000	27,000	+ 6,000
Total	30,000	37,000	+ 7,000
Materials for Western Union Telegraph Co.—			
From United Kingdom ...	4,000	33,000	+ 29,000
,, United States ...	1,000	3,000	+ 2,000
Total	5,000	36,000	+ 31,000
Goods for Anglo-American Telegraph Co.—			
From United Kingdom ...	3,000	51,000	+ 48,000
,, United States ...	1,000	1,500	+ 500
,, Canada	—	1,000	+ 1,000
Total	4,000	53,500	+ 49,500
Scientific instruments.—			
From United Kingdom ...	500	500	—
,, United States ...	1,000	500	− 500
,, Other countries ...	—	1,000	+ 1,000
Total	1,500	2,000	+ 500
Materials for wireless telegraphy.—			
From United Kingdom ...	1,000	1,500	+ 500
,, United States ...	2,000	1,500	− 500
Total	3,000	3,000	—

Dollar = 4s. 2d.

REVIEWS.

Electric Arc Phenomena. By Ewald Rasch. Translated by K. Tornberg. London: Constable & Co. Price 8s. 6d. net.

Before proceeding to deal with the electric arc, the author of this book devotes a dozen pages of introduction to calling attention to certain "facts, which, with exceptional force, should caution us to discreet tolerance and independence of thought on scientific subjects." The "facts" appear to be that, while as late as 1874, Kelvin, Tait, and Von Helmholtz thought to dispose of Newton-Weber's corpuscular theory of light by demanding to be shown a "light corpuscle," and made "unconditional, dogmatic surrender to Maxwell's theory of light," it was unanimously agreed at Salzburg, in 1909, by the highest authorities in theoretical physics (Einstein, Planck, Born-Minowski, A. Sommerfeld, and others) that Maxwell's theory of the universe and his ether hypothesis "must plainly be considered as obsolete." We agree with the author that scientific dogmatism is deserving of whole-hearted condemnation; we also agree that Maxwell's theory, while true for electromagnetic waves of great length, is inapplicable to the shorter waves which constitute the visible spectrum; and we fully appreciate the ingenious Planck-Einstein "Licht-quanten Hypothese" and Minkowski's time-co-ordinates. But there is surely a great gulf fixed between Newton's corpuscles and Einstein's light units; and there are surely *some* authorities in theoretical physics outside of Germany! It must be remembered that Sir J. J. Thomson, whose work on the electron in England ranks with that of any scientist, has alternatives even to Einstein's theory; and Dr. Wood of Baltimore, whose researches in physical optics give some weight to his opinion, remarks that "we may eventually be driven to a compromise between the old corpuscular theory and the wave theory." In fact, there is no unanimity among the world's scientists concerning the Planck-Einstein theory, and the consignment to oblivion of Maxwell's theory by the learned diet of Salzburg and the unanimity of *their* opinions does not convince us that Maxwell, Kelvin, Tait, and Von Helmholtz were the dogmatic blockheads that the author would lead us to suppose.

The author states that "the development of our mental pictures of a civilised world and of a physico-technical universe has been hindered, with more dire results, from the point of view of political economy, than were ever caused by the most bitter religious strife." The ideal of a physico-technical universe does not appear to us to be entirely desirable, but even supposing such a state *has* been postponed by this combat between rival theories, we decline to believe that men of the calibre of Kelvin and Tait have had any part or lot in the matter. The fact that even Goethe has devoted "several volumes of the sharpest kind of controversy against Newton, without making it clear to himself, or to us, what he is driving at," does not alter our opinion concerning the honesty of purpose of the great physicists of the nineteenth century.

The treatment of the electric arc is exceptionally complete—probably the most exhaustive monograph on the subject yet published.

The first chapter deals with the history of the electric arc, and rightly attributes the pioneer work to Davy. Some well-illustrated sections are devoted to the formation, starting, and

adjustments of arcs and the various types of arcs, D.C., A.C., and enclosed. In the third chapter electrode materials and their physical properties are described very fully. In this section the author points out the lack of experimental knowledge concerning emissive powers of substances at high temperatures, remarking that it is in this direction that the illuminating engineer will have to seek guidance for progress towards perfection of illuminants by the selection of efficient electrode materials.

There are short chapters on the theory of electrical discharges and spark discharges in which the excellent work of Steinmetz, Earhart, and Russell is briefly referred to; but the main portion of the book is devoted to the study of the voltage and current conditions, and the distribution of energy in the arc. In the former of these subjects the classical work of Mrs. Ayrton is made the basis of the treatment. Her study of the carbon arc is undoubtedly the most exhaustive yet made, and although the author modifies his equations to suit the results of the more recent experiments of Grau and Toepler, he relies on the Ayrton results and the Ayrton-Thompson equations for the greater portion of his treatment of the carbon arc. Perhaps the most important criticism that Rasch makes of Hertha Ayrton's experiments is in connection with her method of measuring the arc-length. Usually, like Hertha Ayrton, one denotes and measures the length of the arc as the axial distance between the edge of the anode crater and the point of the cathode. In reality, however, the true length of the arc., *i.e.*, the length of the current-carrying gas column, is longer by the depth of the crater, a depth which is not entirely independent of the arc length and the current. The introduction of this true arc-length results in the correction and simplification of Ayrton's equation from

$$e = g + al + (\gamma + \delta l)/\imath \qquad (1)$$

to

$$e = m + l\,(a + \delta/\imath) \qquad (2)$$

where e, l, and $\imath$ are volts, millimetres and amperes respectively and the constants are in (1) $g = 38.88$; $a = 2.074$; $\gamma = 11.66$ and $\delta = 10.54$; while in (2) $m = 36.59$; $a = 2.074$, and $= 10.54$.

Extending the theory to metallic electrodes, it is found that the value of δ is a linear function of the specific heat, and on page 97 a diagram is given indicating this relationship. Unfortunately, the linear law derived is quite wrong, and should read $\delta = 23 - 62c$ instead of $\delta = 23 \times 4\,(1 - 2.7c)$.

Very little attention is given to mercury vapour lamps and hematite arcs, but the ordinary commercial types of arc are fully dealt with and valuable efficiency data are given.

On the whole, the German of Rasch is done into very fair English by the translator (Tornberg), but occasional obscurities and inaccuracies mar the translation. The German construction, in which the verb is eventually brought to heel near the end of the sentence, is occasionally met with, and the punctuation is erratic.

While the present work is a useful monograph on the subject, we do not think that it is by any means the last word on the electric arc, at any rate, so far as physicists and electrical engineers in this country are concerned.—P. H. S. K.

An Introduction to Applied Mechanics. By E. S. ANDREWS, B.Sc. Cambridge: University Press. Price 4s. 6d. net.

A preliminary survey of the pages of this book is sufficient to convince us that Mr. Andrews has had experience of the difficulties met with by students of mechanics, and that he is no novice in the art of text-book writing. A closer study deepens the conviction that the prefatory remarks are not the idle platitudes that we are accustomed to look for in prefaces, but are the sober truths concerning the present methods of teaching applied mechanics.

The author's experience leads him to the conclusion that the chief difficulties encountered by both teachers and students in applied mechanics are due to the treatment in the older form of text-book being too much that of applied mathematics—a kind of exercise ground for algebraic manipulation—and that in attempting to remedy this, the modern books have given too much engineering application of the principles of mechanics without sufficient explanation of those principles. Practical teachers of mechanics will recognise that Mr. Andrews has thus effectively summarised the defects that have rendered most class-books of mechanics useless for the instruction of engineering apprentices and the younger students in engineering colleges.

But the author has not only accurately diagnosed the weakness of the ordinary text-book; he has, in the 300 pages of this volume, prescribed a valuable remedy. He has avoided making his book into a course of mathematical gymnastics; at the same time, he has not gone to the other extreme and crowded out the adequate explanation of principles by practical examples and applications. The book before us is, in fact, a well-balanced treatise, in which a true view is kept of the relations between principle and practice, theory and experiment.

The order of treatment is somewhat unusual. Chapter I deals with Vectors, followed by Moments and Leverage, and Work, Power and Energy—subjects usually treated *after* the application of vectors to velocity, relative velocity and accelerations. Machines and Efficiency are dealt with in Chapter IV, and then the usual treatment of vectors is resumed, followed by chapters on Energy, Momentum, and Newton's Laws. The book does not appear to suffer on account of this deviation from the usual order of treatment, and even the subject of Work, Power and Energy is successfully negotiated in spite of the postponement of the velocity and acceleration section. There are very obvious advantages in the introduction of moments and leverage and machines at an early stage, and, since the ideas of velocity and force are commonplace ideas which scarcely need definition, there appears to be no reason why the old order should not give place to the new.

There are excellent chapters on Stress and Strain, Riveted Joints, Frames, Beams, and Girders. Chapter XIII is a somewhat belated treatment of Centres of Gravity, a subject that might well have made an earlier appearance in the book; and another section that seems somewhat out of place is a chapter on curvilinear motion inserted between "Friction and Lubrication" and "Mechanisms and Gearing." All these subjects are, however, treated with remarkable clearness and practical insight.

The book is well illustrated; worked examples and descriptions of laboratory experiments are frequent, and every chapter is carefully summarised; and there are sets of well-chosen exercises following every one of the 17 chapters. An appendix includes trigonometrical tables, weights and measures, and some useful constants. The book is well bound and printed, and is in every way likely to fulfil the hope of its author "that it may be found of value as a class-book in the junior classes of engineering colleges and in public schools that have an engineering side."—P. H. S. K.

Continuous and Alternating-current Machinery Problems. By W. T. RYAN. London: Chapman & Hall, Ltd. Price 2s. 6d. net.

The average technical student is apt to find general principles and mathematical theory rather vague, and to enable him to get a genuine grasp of a subject—particularly a subject like electrical engineering—considerable practice with numerical examples is essential. This small volume, emanating from America, has been designed for administering a short elementary course of such examples.

On the whole, the problems are well chosen, and bear a resemblance to those with which an engineer meets in practical work. They cover a wide ground, and occasionally notes and hints for their solution are given. By people trained in this country, problems involving "circular mils per ampere" will probably be ignored.

The answers are not given—thus making the book of little use to a private student—and considering that the total number of pages is only 37, the price appears to be on the high side.—H. G. S.

NOTES.

Electrical Machinery for China Stopped.—With reference to the proceedings before the Prize Court in London, reported on page 748 of our issue of December 10th, we have received a communication which makes it necessary to state that the concern for which Mr. Dunlop asked for the release of certain electrical machinery was the Peking Electric Co. and not the Peking Chinese Electric Light and Power Co., Ltd. We have also received a copy of the *Peking Gazette*, in which a letter appears amplifying the explanation which we have just given. Mr. A. O. Buckingham, engineer-in-chief to the Peking Chinese Electric Light and Power Co., Ltd., there writes as follows:—

> In case there should be any misconception as to which is the Peking Electric Co., and which is the Peking Chinese Electric Light and Power Co., Ltd., I would point out that the former has an order, which it enjoys in common with the Peking Chinese Electric Light and Power Co., Ltd., to supply in the Legation Quarters, and in no other part of Peking, whereas the Peking Chinese Electric Light and Power Co., Ltd., has power to supply over the whole of Peking including the Legation Quarters.
>
> It will, therefore, be clear that the function of the Peking Electric Co. is more specific than general, and such terms as "Chinese Public Lighting Installation," and "Electric Light Co. of Peking," could only in their common acceptation be taken to refer to the Peking Chinese Electric Light and Power Co., Ltd.
>
> The reason I am compelled to deal with this matter is, that my company's business is being seriously handicapped, owing to its being confused with the Peking Electric Co.

Mr. Buckingham's company has placed in England considerable orders for goods of which it is in great need. These goods are already very much overdue, and any doubt as to the identity of his company would cause the goods to be further delayed.

Fatality.—SHEFFIELD.—An inquest has just been held on a 16-year-old boy named C. H. Roper, who met his death from electric shock while having a bath. His brother John had fixed an electric lamp in the bathroom with flexible wire secured by tacks. Owing to the blind falling, John endeavoured to remove the lamp bulb (on account of the lighting regulations), but it was too hot to hold, and fell, with the wire attached, into the bath. The lad in the bath got so severe an electric shock that he died almost immediately. The pressure was 200 volts.

The Future of Electric Steel.—An article in the *Ironmonger* states that the number of electric furnaces in the United States has increased during the past 12 months by 32 to a total of 73, and the American total now exceeds by 20 that of Germany, which had previously occupied the first place in this branch of industry. Of the German furnaces 16 are melting ferro-manganese, and, consequently, are not a factor in the steel trade. The American development of electric melting has been mainly in the production of steel castings of ordinary analysis, but more solid and free from blowholes than can be obtained by the baby Bessemer or the open-hearth process, and of alloy steels ranging from the high-priced "quality" steels used for aeroplane and automobile construction up to tool steel itself.

Even in Sheffield electric melting is making rapid headway; 15 furnaces were installed last year, of which eight are employed in melting high-speed steel. There is great scope for the electric furnace outside the manufacture of tool steel. New kinds of steel are in demand which can be successfully made only in that furnace, and the call of the aeroplane, automobile, and other progressive industries for steels of higher quality is compelling recourse to the same system. Statistics indicate that progress is chiefly with the arc type of furnace, which is making rapid strides everywhere. In the United States there are 68 against two of the induction type, and in other countries the number is 179 against only 35 induction furnaces.

According to the *Iron Age*, the total number of furnaces in operation for electric melting of steel has increased from 213 to 303. Germany now takes second place with 53, an increase of only six. Progress was greater in England than in any other European country, our number of furnaces having gone up from 16 to 46, and there is every probability of the same rate of increase being maintained in the near future. A considerable number of contracts for new installations have been placed or are under consideration, and many more will be needed if steelmakers in the country lay themselves out (as is highly probable) to capture a share of the huge trade in small steel castings which in the past has been left largely in the hands of Continental firms. There is a decided opening for a small electric furnace of moderate first cost and simple design, both for the production of small castings and special steels for various purposes.

During the year Sheffield has installed or contracted for electric furnaces as follows:—Hadfields, Ltd., 5; Vickers, Ltd., Thos. Firth and Sons, Ltd., John Brown & Co., Ltd., and Brown, Bayley's Steelworks, Ltd., two each; Arthur Balfour & Co., Ltd., S. Osborn and Co., Ltd., and the University of Sheffield, one each. The whole of these furnaces are of the Héroult type, and range in capacity from 3 to 10 tons. Eight of them are producing tool steel and the remainder castings and war material. The following British firms have also installed or are installing electric furnaces: London Foundry Co., Ltd., Brimsdown; Daimler Motor Co., Ltd., Coventry; Thwaites Bros., Ltd., Bradford; and T. Summerson and Sons, Ltd., Darlington.

As regards types, the Héroult furnace stands first with a world total of 115 out of 303, induction furnaces ranking second with 38, the Rennerfelt third with 35, and the Grönwall next with 15. The number of Héroult furnaces in the United States has increased from 19 to 43. Other figures for the same country are Snyder 14, Wile 7, and Rennerfelt 2. There are also 4 Rennerfelt installations in England at the following works:—Edgar Allen & Co. Ltd., Sheffield; A. Kenrick & Sons, Ltd., Birmingham; Steel Castings, Ltd., Birmingham; and Electro-Flex Steel Co., Ltd., Dunston. There are 11 electric furnaces in Russia, 23 in Sweden, and 6 in Norway. In Canada the manufacture of steel by electric melting is carried on by Electric Steel and Metals, Ltd., Ontario; Armstrong, Whitworth, of Canada, Quebec; Thomas Davidson Manufacturing Co., Montreal; and the Canadian Brake and Shoe Co., Quebec, these firms having 8 furnaces among them.

In the foregoing extracts it is not made clear whether the considerable number of electric steel furnaces installed by Messrs. Electrometals, Ltd., in Sheffield and other English towns are included. These furnaces were described in our issue of October 8th, 1915.

Institution and Lecture Notes.—Insurance Institute of London.—On Monday afternoon last Mr. Alfred Hands, delivered the first of two lectures on "Storms, Lightning, and Lightning Conductors," at Gresham College, E.C. The second lecture will be given on Monday, February 28th, in the Hall of the Insurance Institute at 11, Queen Street, E.C.

Institution of Electrical Engineers.—A special general meeting of the corporate members of the Institution will be held on Wednesday, March 1st, at 5 p.m., for the purpose of considering and, if thought fit, of passing the following resolution as an extraordinary resolution with the view to its subsequent confirmation as a special resolution:—

"That the following words be added to Article 41 of the Articles of Association, namely:—(*a*) In the event of a state of war arising between the United Kingdom of Great Britain and Ireland and any other country or State, any member of any class who at any time during such war shall be a subject of such enemy country or State shall forthwith cease to be a member of the Institution, and in the case of the European War of 1914 all such members shall cease to be members of the Institution on and after the 16th day March, 1916."

Should the above resolution be passed by the requisite majority, a further special general meeting will be held on March 16th, when the said resolution will be submitted for confirmation as a special resolution.

The Committee of the Privy Council for Scientific and Industrial Research has made the following grants to the Institution for one year's research work:—Heating of buried cables, £840; properties of insulating oils, £250.

The provisional programme of the BIRMINGHAM LOCAL SECTION for the second half of this Session includes the following:—

February 23rd.—Dr. C. Chree—Kelvin Lecture on "Terrestrial Magnetism."
March 15th.—Mr. N. W. Storer—"The Possibilities in the Design of Continuous-Current Traction Motors."
April 12th.—To be arranged.

MR. C. P. SPARKS, president, accompanied by MR. P. F. ROWELL, secretary, was present at a meeting of the NEWCASTLE LOCAL SECTION on the 15th inst. Mr. P. V. Hunter presided, and there was a very good attendance, including many of the principal electrical engineers in the district, who offered the visitors a hearty welcome. The President addressed the meeting on the work of the Institution, and afterwards a paper, with lantern illustrations, was given by MR. R. W. GREGORY, dealing with the Roman Wall. The arrangements were admirably carried out by Mr. J. R. Andrews, the local secretary.

Birmingham Electric Club.—On Saturday last a paper was read by Mr. H. W. Wolton on "Electric Welding."

Electrolytic Copper in Germany.—According to *Industria e Invenciones*, a new factory is to be started in Germany for the refining of copper by electrolysis, at Bitterfeld, the owners being the Hüttenwerke, of Niederschöneweide. The energy required will be 2,000,000 KW.-hours yearly, which will be supplied by the power station at Golpa Jenseni'z. This will make the third electrolytic copper works in the German Empire.

Electricity at Dublin Quays.—In the High Court, Dublin, Mr. Justice Pim made a consent a rule of Court in a case by the Corporation against the Port and Docks Board and the Steam Packet Co., in regard to the opening-up of the quays for the laying of electric wires from the pathway. The settlement provides for notice of intention to open, the city engineer to require defendants to guard against the interruption of the city electricity supply and other utilities.

Volunteer Notes.—ENGINEERING INSTITUTIONS' VOLUNTEER ENGINEER CORPS.—Orders for week commencing February 21st, 1916.—By Lieut.-Col. C. B. Clay, V.D., Commandant.

Drills, 6.25 to 7.25; 7.25 to 8.25 p.m.

Monday, February 21st.—Sections 1 and 2, Technical; Sections 3 and 4, Lashings and Trestle Bridging, Signalling Class and Recruits.

Tuesday, February 22nd.—School of Arms, 6 to 7 p.m.

Thursday, February 24th.—Shooting for Sections 1 and 2, and Signalling Class.

Friday, February 25th.—Sections 3 and 4, Technical; Sections 1 and 2, Lashings and Trestle Bridging; Signalling Class and Recruits.

Saturday, February 26th.—Uniform Parade, 2.45 p.m.

E. G. FLEMING,
Company Commander and Acting Adjutant.

3RD BATT. (OLD BOYS) CENTRAL LONDON VOLUNTEER REGIMENT.—Battalion Orders by Colonel S. G. Grant (Officer Commanding), Thursday, February 17th, 1916:—

Week-end Parades.—Saturday.—The Battalion will parade at Wembley Park at 3.15 p.m. for drill under Company Officers. "Derby" recruits are invited to attend.

Sunday.—The Battalion will parade at Liverpool Street Station (low-level entrance, G.E.R.) at 9.30 a.m., and proceed by train for Entrenching duties. Members will carry their own lunch. The Battalion will return to town about 6 p.m.

Winter Quarters.—The Fatigue Party, under Corporal Manning will parade, as usual, at Wembley Park, on Saturday and Sunday next.

Musketry.—There will be a Shooting Match at Bisley on Saturday next, the 19th inst. Parade in uniform at Waterloo Station, No. 9 Platform, at 12.45 p.m.

A. G. JOINER, *Major and Adjutant*, O.B.C.

For Sale.—The Stoke-on-Trent Electric Supply Committee has for disposal two Belliss and four Raworth engines, D.C. and A.C. generators. See our advertisement pages to-day.

Rock Drills.—Replying to the discussion on a paper on "Compressed Air for Coal-Cutters," which he read at a meeting of the Mining Institute of Scotland, in Edinburgh, on Saturday, Mr. Sam Mavor said the complaint that a satisfactory electric rock drill had not been produced was a valid one, but he now believed that the days of the compressed-air rock drill were numbered. He had recently seen in operation a rock drill constructed in accordance with a novel system of power transmission, which absorbed only one-fifth of the power required by a compressed-air drill, and could be used in association with any electrical plant. The system had features which differentiated it from any other attempts to compete with the compressed-air drill, and he believed it was destined to revolutionise all branches of civil engineering and mining which were based upon rock drilling.

Flood-lighting—a Contrast.—We reproduce herewith from the *Electrical World* a view of the "matchless Tower of Jewels" at the San Francisco Exposition, as it appeared at night. This will interest readers in this country, especially residents in

the city of ——, and will assist their imaginations to conjure up some idea of what might be there were it not otherwise ordained. After the war, perhaps—

Farm Supply in Eastern Pennsylvania.—A recent issue of the *General Electric Review* contains an article by Mr. J. W. Price on the subject of rural development of transmission lines which details more particularly the experience of two companies in the supply of electricity to farms. The first company has acquired its rural consumers incidentally, but having been led to investigate matters is establishing a definite policy for acquiring farm consumers. It has at present 125 such consumers, and has put up 12 miles of special lines in quarter to half mile lengths, the majority of the farms being connected to lines put up for other purposes.

Of the 125 farmers mentioned, 30 are power consumers, and all are users of light. The 95 consumers using only light give an average revenue of £3 15s. a year; the average revenue per farm power consumer (including lighting) is £16 18s. a year. The supply is charged at 6½ d. per unit for lighting, less 20 per cent. discount, and 2½d. per unit for power, less 10 per cent. discount, with a monthly minimum bill of 4s.

The total farm power load is 412 H.P., or 307·35 KW., and the total farm load (including lighting) 432·35 KW., representing 3·46 KW. per consumer, and a demand of 55,000 units, rather more than half being lighting units.

The second company adjoins the one just referred to, and has 32 miles of lines, much of which, however, is used jointly for telephone and power wires. Current is being supplied for street lighting, but the principal load consists of farms, to whom a special tariff is offered, one of the conditions of contract being that where the prospective load is not such as to warrant an extension at the company's expense, the extension will be installed if the consumer agrees to guarantee revenue within two years to cover the cost of the extension. The customer pays for and maintains his transformer and main switch, with the idea that he will switch off his transformer when not in use, and save core loss.

The lighting rate is 6½d. per unit, less 10 per cent., with minimum charges; cooking, heating, battery charging and motor service above 1 H.P. are classed as power, and supplied on a sliding scale varying from 4d. to 2½d. per unit, with 10 per cent. discount and minimum charges.

There are 40 farm customers, and 30 use both light and power, the total motor load being 325 H P, of which 228 H P. is distributed amongst the 30 consumers referred to, giving an average of 7½ H.P. each. The company has now adopted a standard 10-H.P. motor for its consumers.

Six consumers, representative of the whole, show an average yearly revenue for power and lighting of £15; for 40 farms the total is taken at £578. Three of the farms have their motors mounted on trucks, and it may be noted that vacuum cleaners, washing machines, sewing machines, irons, &c., have been adopted in considerable numbers.

It is mentioned that the tendency is to keep the H.P. rating down with a view to distributing the load throughout the day; also that experience shows that it is only a short time before the lighting consumer adopts electric power appliances.

None of the consumers above mentioned employ irrigation pumping.

Italian Progress in Electrochemistry.—The prizes awarded yearly by the Brambilla Foundation for inventions or processes calculated to be of advantage to the population of Lombardy, have, for 1915, been awarded, as regards the first prize, to the Società Anonima Ferriere di Voltri, of Voltri and Darfo, for alloys of iron produced in the electric furnace, &c., and for the impulse it has given to electrometallurgical production in Italy. The second prize is awarded to the Società Elettrica e Elettrochimica del Caffaro, of Milan and Brescia, for an electrolytic substance styled "Pasta Caffaro," for the prevention and combat of the vine disease termed peronospora.

Electricity Works as "Controlled Establishments."—The Glasgow Electricity Committee has appointed a Special Sub-Committee to confer with representatives of the Gas Committee as to the question of making application to have the electricity department declared a "controlled establishment."

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the Electricity Works, Stamford, Mr. F. H. BRANDRETH, the resident engineer (Lieutenant, 67th Provisional Territorial Force), was presented by the staff with a pair of silver candlesticks on the occasion of his marriage. Mr. J. E. Edmundson made the presentation.

Mr. T. K. RICHARDSON, station superintendent at the Marylebone B.C. electricity works, who was granted three months' leave of absence on November 4th, owing to illness, has been granted a further three months' leave.

Mr. R. PARKER has retired from the position of foreman at the Bristol T.C. electricity works after 22 years' service, and Mr. J. STAPLETON has been appointed his successor at a salary of £169 per annum. Mr. Parker's health has broken down, and at the Council meeting the question of a pension was raised. Alderman Pearson replied that there was no scheme in existence under which Corporation workmen could receive a pension, the Council having refused to listen to his own proposals on the matter. Mr. Parker was entitled to every consideration. The Committee is to report upon his case. One member proposed that he be granted a year's salary.

The St. Marylebone B.C. has increased the salaries of the following members of the electricity supply staff:—Mr. W. HARPER, assistant accountant; Mr. W. H. SHORTER, chief assistant, sales department; and Mr. C. H. CAPE, shift engineer.

Mr. E. J. WALSH, chief assistant engineer to Kilmarnock Corporation, where he has been for the past four years, has been appointed resident engineer by the Musselburgh and District Electric Light & Traction Co., Ltd.

Petty Officer S. HANN, attached to the *Hawke* Battalion, R.N. Division (borough electrical engineer, Stoke Newington), received special mention in a dispatch by General Sir Ian Hamilton on September 22nd, 1915.

Mr. J. LEWIS, assistant engineer at the Sleaford Urban Council electricity works, has resigned.

General.—At a complimentary dinner, given on Saturday, 5th inst., at the Princess Restaurant, Newcastle-on-Tyne, Mr. J. SPENCE was presented, on the anniversary of his 21 years as district manager of the General Electric Co., Ltd., with a silver rose bowl by the staff.

The Committee of the Privy Council for Scientific and Industrial Research has appointed the Hon. Sir C. A. PARSONS, F.R.S., to be a member of the Advisory Council, in place of Prof. Bertram Hopkinson, F.R.S., who has been forced to resign by the pressure of duties connected with the war; and Prof. J. F. THORPE, F.R.S., to fill the vacancy caused by the death of Prof. R. Meldola, F.R.S.

Mr. T. G. TRAVIS has resigned his position as general sales manager with the Electrical Apparatus Co., Ltd., in order to join the sales organisation of the British Westinghouse Co., Ltd., at Trafford Park, and will commence his new duties on the 17th inst. Mr. Travis was previously with the British Westinghouse Co. for some years, subsequently joining the Electrical Apparatus Co. as Manchester representative.

The Illuminating Engineering Society (U.S.A.), on February 10th, gave a banquet in New York in honour of Mr. T. A. EDISON, who was made an honorary member.

Private M. F. BELLIVEAU, electrical engineer, of the 55th Canadian Infantry, was married last week at the Catholic Church of St. Lawrence, Petersfield, to Miss Ruth Maude Gibbins.

Roll of Honour.—Trooper JOSEPH WM. ODELL, of the Berkshire Yeomanry, who was on the staff of the Pulsometer Engineering Co., Ltd., of Reading, and had served with the regiment in Egypt, has died from consumption.

The D.C.M. has been awarded to Sergeant COLIN MORRELL, of the 2/1st West Riding (Sheffield) Royal Engineers, who was, before enlistment, underground electrician at the Hickleton Main Colliery.

Private DAVID QUINN, of the 7th Battalion Lancashire Fusiliers, formerly employed by Messrs. W. T. Glover & Co., Ltd., at Trafford Park, has been wounded, and is in hospital at Cairo.

The D.C.M. has been awarded to Private F. MOTTERSHEAD, of the 7th Battalion Lancashire Fusiliers, formerly employed by the British Westinghouse Works, Trafford Park.

We are sure that our readers will join with us in congratulations to the President of the Institution of Electrical Engineers, Mr. C. P. SPARKS, upon the honours gained by two of his sons who are with the Forces. Reference was made to the matter at last week's meeting of the Institution. The facts are these:—Lieutenant A. C. SPARKS, R.E., received the Ribbon of the Military Cross from his Corps Commander in France on February 5th. This was awarded him following the night attack on January 11th-12th, 1916. Captain HARRY SPARKS, Suffolk Regiment, was decorated by the King at the Investiture on January 15th, 1916, with the Military Cross, awarded February, 1915.

Obituary.—SIR C. RIVERS WILSON.—We regret to record the death, which occurred on February 9th in London, at the age of 85 years, of Sir Chas. Rivers Wilson. The deceased gentleman was for some years chairman of the British Electric Traction Co., Ltd., also of the Rand Central Electric Works, Ltd., which was taken over by the Victoria Falls Power Co.

MR. HERBERT KINGSFORD.—Mr. Herbert Kingsford, whose death was announced here last week, was chief of the staff of the Central and South American and Mexican Telegraph Companies. Mr. Kingsford began his career with the Telegraph Construction & Maintenance Co., and took part in some of the Atlantic cable-laying expeditions of the *Great Eastern*. He afterwards joined the Commercial Cable Co., and sailed in the ill-fated *Minia*, but later was for many years in Peru with the companies first named. He was patentee of a bell-ringing grapnel used by cable-laying concerns.

MR. BELVEDERE BROOKS.—The *Daily News* reports the death of Mr. Belvedere Brooks, of the Western Union Telegraph Co., who began as a messenger boy in 1870 and worked his way up to the top.

MR. JOHN WOOD.—We regret to record the death, in his 65th year, of Mr. John Wood, which ocucrred on 14th inst. at his residence at Forest Hill. The deceased gentleman was senior partner in the firm of Mosses & Mitchell, of Chiswell Works, Golden Lane, E.C., and a director of several London firms.

NEW COMPANIES REGISTERED.

Scott Electrical Co., Ltd. (142,870).—Registered February 9th, by Pepper, Tangye & Winterton, 34, Waterloo Street, Birmingham. Capital, £100,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in lighting sets and starting apparatus, lamps, dynamos, magnetos, and electrical and other apparatus, and accessories of all kinds, and parts thereof, for use in connection with motor vehicles, airships, aeroplanes, seaplanes, boats and ships, manufacturers of and dealers in such vehicles, and cycles, carriages and other conveyances for use on the road, in the air, or on the sea, electrical, mechanical, hydraulic, automobile and general engineers, etc., and to adopt agreements with the Efandem Co., Ltd., and Jesse Varley. The subscribers (with one share each) are: J. Varley, Elmsdale, Wightwick, Wolverhampton, accountant; R. H. Johnston, 49, Queen Street, Wolverhampton, chartered accountant; P. Smith, Ravensholt, Sunnetfield, Wolverhampton, secretary; F. H. Pepper, 34, Waterloo Street, Birmingham, solicitor; H. Walker, 117, Poplar Avenue, Edgbaston, Birmingham, managing clerk; J. E. Smith, 78, Springfield Road, King's Heath, Birmingham, cashier; J. W. Harvey, 28, Algernon Road, Birmingham, accountant. Minimum cash subscription, 25,000 shares. The first directors (to number not less than three or more than ten) are: J. Varley; E. J. Hardy, Alverstone, Park Road, Coventry; and G. R. Cornwallis, Roseland, Albemarle Road, Norwich. Until otherwise determined the said directors shall form a committee of management of the board of directors. The Efandem Co., Ltd., shall for a period of ten years have the right to nominate a director, so long as they hold 500 shares. Qualification (except such nominee), £500. Remuneration (except managing director), £50 each per annum (chairman £100). Each member of the management committee of the board shall receive a further £200 per annum as remuneration. Registered office: National Provincial Bank Chambers, Queen's Square, Wolverhampton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bullers, Ltd. (62,020).—Capital, £400,000 in £10 shares (20,000 pref.). Return dated December 29th, 1915. 15,000 ord. and 15,000 pref. shares taken up; £10 per share called up on 7 ord. and 15,000 pref.; £150,070 paid; £149,930 considered as paid on 14,993 ord. shares. Mortgages and charges: Nil.

Gambrell Bros., Ltd.—Land Registry Charge on the company's "Electrical Laboratories" in Merton Road, Southfields, dated January 12th, 1916, to secure all moneys due or to become due from company to National Provincial Bank of England, Ltd., 153, High Street, Putney, S.W.

Osram-Robertson Lamp Works, Ltd. (formerly Osram Lamp Works, Ltd.) (95,312).—Capital, £250,000 in 7,500 "A" and 2,500 "B" shares of £10 each, and 150,000 pref. shares of £1 each. Return dated December 9th, 1915 (filed January 7th, 1916). 7,500 "A," 2,500 "B," and 128,250 pref. shares taken up; £10 per share called up on 5,000 "A"; £50,000 paid; £178,250 considered as paid on 2,500 "A," 2,500 "B," and 128,250 pref. shares. Mortgages and charges: £24,000.

Kingolite Co., Ltd.—A memorandum of satisfaction to the extent of £50 on January 6th, 1916, of debenture dated July 9th, 1914, securing £400, has been filed.

John Spencer, Ltd. (56,764).—Capital, £75,000 in £5 shares (10,000 pref.). Return dated December 21st, 1915 (filed January 5th, 1916). 10,000 pref. and 1,027 ord. shares taken up; £55,135 considered as paid on 11,027 shares. Mortgages and charges: £25,000.

Robert W. Blackwell and Co., Ltd.—Capital, £250,000 in £1 shares. Return dated January 14th, 1916 (filed January 27th). All shares taken up; £1 per share called up on 100,007; £100,007 paid; £149,993 considered as paid on 149,993 shares. Mortgages and charges: Nil.

Aluminium Foil Co., Ltd.—Mortgage dated December 8th, 1914, to secure £1,500, charged on the Bridge Road Engineering Works, Harlesden. Holders: International Foil Co., Ltd., 195, Strand, W.C. (Registered February 2nd, 1916, pursuant to Order of Court).

Pernambuco Tramways and Power Co., Ltd.—Issue on January 11th, 1916, of £100,000 debentures, part of a series of which particulars have already been filed.

Enfield Electric Cable Manufacturing Co., Ltd.—Deed of further charge on certain hereditaments and premises dated January 27th, 1916 (supplemental to mortgage dated November 5th, 1914), to secure £2,750. Holders: Viscount Grimston, The Camp, St. Albans; G. J. Andrews, 140, West Campbell Street, Glasgow; and F. Plutte, Fountainbleau, Dacres Road, Forest Hill, S.E.

Bourne End Electric Installation Co., Ltd. (98,428).—Capital, £5,000 in £1 shares. Return dated December 30th, 1915. 1,000 shares taken up; £7 paid; £993 considered as paid. Mortgages and charges: £2,000.

Westinghouse Cooper Hewitt Co., Ltd. (89,947).—Capital, £30,000 in £1 shares. Return dated December 17th, 1915. All shares taken up; 9s. 6d. per share called up; £14,250 paid. Mortgages and charges: Nil.

CITY NOTES.

St. James' and Pall Mall Electric Light Co., Ltd.

Mr. WALTER LEAF, presiding at the annual meeting on Tuesday, said that they had to recognise that their industry had yet to suffer for an indefinite time under conditions which were wholly adverse and brought no war profits. Last year they set aside £4,500 to be used this year for the equalisation of dividends, hoping to maintain the rate at 10 per cent., but conditions had been worse than they anticipated. Their estimate of reduced revenue was correct, but expenses had exceeded the estimate by £3,000. The loss of profit due to the war was, therefore, about £12,000 additional, and they were only able to pay 8 per cent. The increased expenditure showed itself chiefly in the accounts of the Central Co., on which they relied more and more for their supply. The cost of the unit for electricity purchased had risen materially, and it had been thought desirable by the two companies concerned that, in order to keep down the cost, the Central Co. should not declare a dividend for 1915; they would thus be that amount short in next year's revenue. They had had to renovate the plant at Grove Road Works, and had added a large new turbo-generator and boiler plant. A large reserve of coal had had to be held. These two causes involved considerable capital expenditure, which must be provided by the companies until it could be made up out of the large provision for depreciation. For this reason they were proposing to extend the borrowing powers. They had entered into an arrangement with their neighbours, the Marylebone Borough, for mutual support in the event of certain emergencies. 64 of their men had joined the Colours, and six had been killed. Theirs was accepted as a public utility undertaking, and a number of their skilled staff were to receive war service badges. Their investments, which cost just over £55,000, stood at £45,716 at December last. They were not ear-marked for any special purpose, and, unless some unforeseen necessity arose they intended to hold them until the liquidation of the business. If at that time there was depreciation, it would be a capital depreciation, and would have to be met out of the capital reserve fund. It was not a depreciation that must be made good out of revenue. In regard to the future, if the war stopped tomorrow they would at once step back into their previous prosperity, but while the war continued profits could not improve. The revenue showed unexpected elasticity in the second half of 1915, and there was a real growth due to extended electrical power and heating business, and to somewhat increased charges to consumers. That increase had been well received, and they would profit more by it in 1916 than in 1915, but it was not a resource upon which they could largely depend. There came a point at which any increase of charge simply meant that the demand was cut down. They looked to increased heating and power demand to make up for the shop lighting loss. The report was adopted, and a resolution increasing the borrowing powers to the extent of £50,000 was also carried.

Westminster Electric Supply Corporation, Ltd.

Lamps, motors, &c., connected increased during 1915 from 41,201 KW. to 42,355 KW. Out of profits £2,000 has been set aside, together with £500 received for founders' shares cancelled in 1897, to the reserve fund; these sums more than cover the loss on investments realised during 1915. After allowing for depreciation, sinking fund and other charges, and paying 8 per cent. final on the ordinary shares, making 7 per cent. for the year, £1,518 is carried forward. Units sold 22,485,878 (including A.C. supply of 1,267,258); used on works 325,690. Annual meeting: February 23rd.

National Electric Supply Co., Ltd.

Mr. John Booth, at the annual meeting on February 9th, said that the company had had to face the loss of many reliable men, increasing expenses for fuel, rates and taxes, and for the greater part of the year a falling revenue; but new consumers had enabled them to end the year with a record output for December. They had had to pay more for loans, and had now raised the rate of interest to 4½ per cent. and 5 per cent. Older machinery had been taken out, allowing for the installation of one of the latest and most efficient turbine sets, by which substantial saving would be effected in the fuel account. The balance on the net revenue was £13,358, against £15,240 a year ago. With an increased output and new machinery, the company was in an excellent position.

Davis and Timmins, Ltd.

The net profit for 1915, including £15,334 brought forward, after allowing for depreciation and manager's commission, was £61,555. After putting £5,000 to general reserve, to income-tax account £2,600, to depreciation on investments £452, paying 6 per cent. on the preference shares, and 8 per cent. on the ordinary, plus a bonus of 15 per cent. free of tax, £39,092 is carried forward subject to the special taxation of the year, the amount of which is at present unascertained. For 1914 the dividend was 8 per cent. and the bonus 15 per cent. Annual meeting: February 24th.

Electrical Distribution of Yorkshire, Ltd.

The net profit for 1915 was £3,634 (1914, £2,964; 1913, £2,569). Steady progress is again reported, and in view of the increased expenditure, the lighting restrictions, and other difficulties occasioned by the war, the results are very satisfactory. After including £602 brought forward, £1,000 is put to reserve, 6 per cent. is paid on the ordinary shares, and £1,031 is carried forward subject to directors' remuneration. The company's strong position is largely due to its close association with the Yorkshire Electric Power Co., and to the benefits of agreements with that company for bulk supply and management. These have enabled the year's difficulties to be met in a manner and at a cost which would not have been possible with separate generating stations and a separate organisation. The Selby and Stanley Provisional Orders have been granted, but they will not come into force until after the war, nor will further applications be considered by the Board of Trade during the war, save under exceptional circumstances. Annual meeting: February 29th.

Smithfield Markets Electric Supply Co., Ltd.—The gross profit for 1915 was £4,250 (£4,576 for 1914), and the net profit £2,816 (£3,139 for 1914). £400 has been put to debenture stock redemption, and £1,250 to depreciation. After paying the dividend of 2 per cent., £1,296 is carried forward. The output was maintained, but costs increased. Matters in dispute *re* existing oil plant have been settled on favourable terms and the cost charged to capital. An improved design oil generating set, to replace the last remaining steam set, will be ready for working in the early spring.

Cambridge Electric Supply Co., Ltd.—During 1915, 99 additional consumers were connected and 1,067,081 units were supplied, an increase of 55,246. The profit was £9,359, plus £2,647 brought forward. Debenture and other interest absorbed £1,793, £3,000 is put to depreciation fund, and, after paying 5 per cent. for the year on the ordinary shares, £2,753 is to be carried forward. The 1914 dividend was 6 per cent. Annual meeting: February 23rd.

Crossley Bros., Ltd.—Final dividend 3 per cent., making 5 per cent. for the year. The amount to credit of revenue account for 1915 was £99,015. £20,000 has been placed to reserve and £30,330 is being carried forward. Capt. Eric Crossley has been elected to the board in place of the late Mr. Brian Crossley (killed in action).

Central London Railway Co.—A dividend of 1½ per cent. is declared on the undivided stock for the past half-year, making 3 per cent. for the year; one of 2 per cent. on the preferred ordinary, making 4 per cent. for the year; and one of 2 per cent. for the year on the deferred ordinary, carrying forward £16,685.

Metropolitan District Railway Co.—After paying the dividend on the 4 per cent. guaranteed stock, and 4½ per cent. on the 4½ pref. stock, a dividend of 1½ per cent. is paid for the last half-year on the 5 per cent. second pref. stock, making 3 per cent. for the year, carrying forward £13,952.

Chelsea Electricity Supply Co., Ltd.—For the last half of 1915 the ordinary dividend is to be at the rate of 4 per cent. per annum, making 4 per cent. for the year; carrying forward about £3,260. The dividend for 1914 was 5 per cent.

London Electric Railway Co.—After paying the full dividend on the 5 per cent. pref. stock, a final dividend of ¾ per cent is to be paid on the ordinary shares, making 1¼ per cent. for the year, carrying forward £12,303.

Telegraph Construction and Maintenance Co., Ltd.—In addition to the interim dividend of 5 per cent. a further dividend of 10 per cent., together with a bonus of 12s. per share, are now announced. The 1914 distribution was at the same rate.

National Boiler and General Insurance Co., Ltd.—Total dividend for 1915, 30 per cent., less tax.

Underground Electric Railways Co. of London, Ltd.—After paying the full interest on the 6th per cent. first cumulative income debenture stock, and on the 6 per cent. income bonds, £38,500 is to be carried forward.

Liverpool Overhead Railway Co.—For 1915 the gross receipts were £95,232, and the working expenses, including appropriation to reserve funds, were £64,435. Passengers carried 15,082,502, as against 13,361,944 in 1914. After paying 5 per cent. on both classes of preference, and 3¼ per cent. on the ordinary shares for the year, £6,873 is carried forward. Annual meeting: February 22nd.

London Electric Wire Co. and Smiths, Ltd.—Distribution on the ordinary shares for 1915: 12½ per cent. (7½ per cent. dividend and 2s. 6d. bonus). £50,000 is put to reserve and £28,559 is carried forward. For 1914 the dividend was 10 per cent.

Mather and Platt, Ltd.—Ordinary share dividend for 1915, 12½ per cent., less tax.

Fredk. Braby and Co., Ltd.—Interim dividend on the ordinary shares: 5s. per share, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

Alteration in the form of this Stock and Shares article and price lists is rendered necessary, of course, by the Government's action with regard to the supply of paper. Journals have to make the best of it they can, without raising unnecessary fuss; and so, so far as this particular section of the Electrical Review is concerned, we say no more than to hope that the excision of various quotations from our lists of securities will not be a matter of noticeable inconvenience to any of our readers. From time to time, it is proposed to add to the accompanying tables others of securities such as those which we are taking out this week; and, as it has been said on former occasions, if there are prices which friends of ours find it difficult to obtain, we shall be always very pleased to do our best to get them.

Round the Stock Exchange markets are generally hard. There is a slight yielding in the prices of Consols and some of the other gilt-edged stocks, thanks to the permission just given by the Treasury to the French holder of British stocks and shares that he may sell in London markets, under stated restrictions. This has dislodged a certain amount of stock which was held on French account, seeking opportunity for some time past to be allowed to sell. Moreover, the shadow of the next War Loan once more drags across the investment markets. It was driven away in the early winter by the issue of Exchequer Bonds; but its advent cannot be delayed much longer, and the probable date assigned to it at present is somewhere in April.

The electric lighting markets are somewhat inclined to heaviness. Chelseas eased off to 3¾ on the reduction in the dividend from 5 per cent. to 4 per cent., but otherwise the list of West End shares is unchanged. South Londons maintain their rise of 3½, thanks to the repetition of the 5 per cent. dividend. There is a little doing in Westminsters, the price keeping hard at £6; while in the preference also there is an occasional bargain marked in the neighbourhood of £4.

City of London ordinary slipped back to 12, and the preference to 10¾, showing falls of 5s. in each case. The declines were associated with fears as to the ability of the company to continue the dividend of 9 per cent. paid a year ago on the ordinary shares. Counties are keeping very steady, and at 10 the price is full of dividend, showing a yield, therefore, of over 7 per cent. on the money, provided the distribution of last year is repeated.

Smithfield Markets Electric Supply Co. shows a net profit of £2,816—a decline of £323 as compared with last year. The dividend is maintained at 2 per cent. The shares have not changed hands since last October, when a bargain was marked at 17s. 1½d. For 1913, by the way, the dividend was 2¼ per cent.

British Westinghouse preference have eased off to 44s. 6d. British Aluminium fell sixpence to 22s.; there are some 6 per cent. preference on offer about 18s., which are cheap as compared with a good many other of the £1 preference shares so popular at the present time. Why there should be a run after this particular class of shares it is difficult to see, but, in point of fact, the preference issue of any sound industrial company is readily taken nowadays, and at a price which looks extravagant when it is compared with the quotations for trustee securities.

The Home Railway market is quiet, with Underground Electric incomes once more the principal feature of strength. The price has risen another ¼ upon the declaration of the full £3 per cent. interest on the bonds. The other dividends from the Associated Electric Railway companies are in accordance with general expectation, but it must be confessed, now that the dividend is out, that none too much certainty was felt about the before-mentioned coupon for £3 being paid in full next month, although the odds were strongly in favour of it. Metropolitan ordinary stock is a dull market at 24, at which

price it still looks too high. Districts loiter about 15, and there is no alteration in Central London stocks.

Brazil Tractions have risen to 51¼, thanks to a recovery in the Rio exchange to 1s., a subsequent reaction to 11 15/16d. being regarded as negligible. The rally wipes out the greater part of last week's fall. Anglo-Argentine Trams are wanted, and most of the other securities associated with the Argentine Republic have come into request, from the National bonds downwards. Mexicans are very weak. No quotable changes are marked in the prices, but the feeling of disappointment deepens—disappointment mainly concerned with the failure of the United States to take any real steps towards the settlement of the country.

The Telegraph market is scarcely so firm. Eastern ordinary has recovered 10s., after its fall of last week; but the Anglo-American group is a little easier, and Globe preference went back to their par value of 10. West India and Panama shares are 1/16 lower. New York Telephone bonds keep at 101½, the Government price. More business in Marconis has resulted in the quotation improving to 1 31/32; but the subsidiaries are dullish in tone, Americans, for instance, being 16s. 3d. and Canadians about 6s. 6d.

Telegraph Constructions, in the manufacturing group, are £1 up at 37; and at 10¾ British Insulated ordinary show a 5s. rise. Babcock & Wilcox keep steady. The armament group is dull, though the Webley & Scott Co. shows its profits quadrupled, as compared with those of a year ago. The rubber market is active and strong, the raw material having risen to 3s. 7d. per lb., which brought in a fresh accession of buyers for all the popular shares.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend, 1914.	Price Feb 15, 1916.	Rise or fall this week.	Yield p.c.
Home Electricity Companies.				
Brompton Ordinary	10	7½	—	£3 18 4
Charing Cross Ordinary	5	8½	—	7 2 10
do. do. do. 4½ Pref.	4½	3½	—	6 0 0
Chelsea	5	8¾	— ¼	6 18 4
City of London	9	12	— ½	7 10 0
do. do. 6 per cent. Pref.	6	10⅝	— ½	5 11 7
County of London	7	10	—	7 0 0
do. do. 6 per cent. Pref.	6	10½	—	5 17 8
Kensington Ordinary	9	6	—	7 10 0
London Electric	4	1⅝	—	8 8 4
do. do. 6 per cent. Pref.	6	4½	—	7 1 2
Metropolitan	5½	9½	—	7 15 7
do. 4½ per cent. Pref.	4½	8	—	7 10 0
St. James' and Pall Mall	10	6	—	8 6 8
South London	5	5½	—	6 8 0
South Metropolitan Pref.	7	1 7/16	—	6 14 0
Westminster Ordinary	9	6	—	7 10 0
Telegraphs and Telephones.				
Anglo-Am. Tel. Pref.	6	100½	—1	5 19 0
do. Def.	38/6	21⅝	—	7 14 3
Chile Telephone	8	6¾	—	6 10 8
Cuba Sub. Ord.	5	7¾	—	6 9 0
Eastern Extension	7	12⅝	—	*6 5 0
Eastern Tel. Ord.	7	127	+ ½	*6 5 6
Globe Tel. and T. Ord.	6	10½	—	*6 12 6
do. Pref.	6	10	— ½	6 0 0
Gt. Northern Tel.	22	84	—	6 8 6
Indo-European	13	49	—	6 15 4
Marconi	5	13 31/32	+ 3/32	5 8 1
New York Tel. 4½	4½	101¾	—	4 8 4
Oriental Telephone Ord.	10	1 1/16	—	5 18 6
United R. Plate Tel.		5/8	—	*7 19 0
West India and Pan.	1	1/16	— 1/16	9 10 6
Western Telegraph	7	12⅝	—	*6 4 6
Home Rails.				
Central London, Ord. Assented	4	69	—	5 16 0
Metropolitan	1½	24	— ½	5 8 6
do. District	Nil	15	—	Nil
Underground Electric Ordinary	Nil	1 5/8	—	Nil
do. do. "A"	Nil	6/-	— 6d.	Nil
do. do. Income	6	8 1/8	+ ⅛	*8 2 0
Foreign Trams, &c.				
Adelaide Sup. 6 per cent. Pref.	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	4¾	—	6 13 6
do. 2nd Pref.	5½	8½	—	7 17 2
do. 5 Deb.	5	79½	—	6 5 6
Brazil Tractions	4	51½ xd	+1½	7 17 0
Bombay Electric Pref.	6	10 xd	—	6 0 0
British Columbia Elec. Ry. Pfce.	5	55	—	9 1 10
do. do. Preferred	—	37	—	Nil
do. do. Deferred	—	34	—	Nil
do. do. Deb.	4½	64	—	6 12 10
Mexico Trams 5 per cent. Bonds	—	42	—	Nil
do. 6 per cent. Bonds	—	37	—	Nil
Mexican Light Common	Nil	29	—	Nil
do. Pref.	Nil	38	—	Nil
do. 1st Bonds	—	42	—	—
Manufacturing Companies.				
Babcock & Wilcox	14	9⅜	—	5 6 8
British Aluminium Ord.	5	23/-	— 6d.	4 1 0
British Insulated Ord.	15	102	+ 1	6 19 6
British Westinghouse Pref.	7½	44 6	— 6d.	6 13 4
Callenders	15	11½	+ ⅛	6 10 5
do. 5 Pref.	5	4½	—	5 17 8
Castner-Kellner	20	7½	—	6 8 0
Edison & Swan, £8 pd.	Nil	7/-	—	Nil
do do. fully paid	Nil	1½	—	Nil
do. do. 5 % Deb.	5	80	—	8 6 8
Electric Construction	6	15/-	—	8 0 0
Gen Elec. Pref.	6	7/8	+ 1/8	6 4 8
Henley	20	14	+ ¼	*8 8 0
do 4½ Pref.	4½	4½	—	5 6 0
India-Rubber	10	9½	—	*12 19 0
Telegraph Con.	20	37	+1	*7 8 6

*Allowance made for dividends being paid free of income-tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 16th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric .. .. per cwt.	..	..
a „ Nitric .. .. .. „	..	..
a „ Oxalic .. .. .. per lb.	1¼	..
a „ Sulphuric .. .. .. per cwt.	..	..
a Ammoniac Sal .. .. „	£70	..
a Ammonia, Muriate (large crystal) per ton	£54	..
a Bleaching powder .. .. .. „	..	..
a Bisulphide of Carbon .. .. „	£28	..
a Borax .. .. „	£25	..
a Copper Sulphate .. .. .. „	£45	..
a Lead, Nitrate .. .. .. „	..	..
a „ White Sugar .. .. „	..	..
a „ Peroxide .. .. .. „	..	..
a Methylated Spirit .. .. .. per gal.	..	..
a Potassium, Bichromate, in casks per lb.	..	..
a Potash, Caustic (88/90 %) .. per ton	..	..
a „ Chlorate .. .. per lb.	1/8	..
a „ Perchlorate .. .. „	1/6	..
a Potassium, Cyanide (98/100 %) .. „ (for mining purposes only)	Nom.	..
a Shellac .. .. .. per cwt.	75/-	..
a Sulphate of Magnesia .. .. per ton	£18	..
a Sulphur, Sublimed Flowers .. „	£13	30/- inc.
a „ Recovered .. .. „	..	..
a „ Lump .. .. „	£9	..
a Soda, Caustic (white 70/73 %) .. „	..	..
a „ Chlorate .. .. per lb.	1/4½	..
a „ Crystals .. .. per ton	60/-	..
a Sodium Bichromate, casks .. per lb.	9d.	½d. inc.
METALS, &c.		
b Aluminium Ingots, in ton lots .. per ton	..	..
b „ Wire, in ton lots (1 to 14 S.W.G.) „	..	..
b „ Sheet, in ton lots .. „	..	..
g Babbitt's metal ingots	..	..
c Brass (rolled metal 2" to 12" basis) per lb.	1/3⅞ to 1/4⅛	1⅛d. inc.
c „ Tubes (solid drawn) .. „	1/4⅜ to 1/5	1d. inc.
c „ Wire, basis .. .. „	1/4⅛ to 1/4⅜	1⅛d. inc.
c Copper Tubes (solid drawn) .. „	1/6½ to 1/6⅝	1•d. inc.
g „ Bars (best selected) .. per ton	£143	£12 inc.
g „ Sheet .. .. .. „	£148	£12 inc.
g „ Rod .. .. .. „	£149	£12 inc.
d „ (Electrolytic) Bars .. „	£135	£12 inc.
d „ „ Sheets .. „	£153	£12 inc.
d „ „ Rods .. „	£142	£ 2 inc.
d „ „ H.C. Wire per lb.	1/4 13/16	1 1/16d. inc.
f Ebonite Rod .. .. .. „	8/-	..
f „ Sheet .. .. .. „	2/6	..
a German Silver Wire .. .. „	2 2	..
h Gutta-percha, fine .. .. „	6/10	..
h India-rubber, Para fine .. „	3/2½	½d. inc.
i Iron Pig (Cleveland warrants) .. per ton	94/5	8/8 inc.
i „ Wire, galv. No. 8, P.O. qual. „	£30	..
g Lead, English Pig .. .. .. „	£32 15	10/- inc.
g Mercury .. .. per bot.	£16 12 6 to £16 15	..
c Mica (in original cases) small .. per lb.	6d. to 8/-	..
e „ „ „ medium „	8/6 to 6/-	..
e „ „ „ large .. „	7/6 to 14/- & up.	..
e Nickel, sheet, wire, &c. .. .. „	Nom.	..
g Phosphor Bronze, plain castings „	..	..
g „ „ rolled bars & rods „	..	..
g „ „ rolled strip & sheet „	..	..
e Platinum .. .. per oz.	..	..
d Silicium Bronze Wire .. .. per lb.	1/6	..
r Steel, Magnet, in bars .. .. per ton	£85	..
g Tin, Block (English) .. .. „	£184	£2 10 inc.
a „ Wire, Nos. 1 to 16 .. .. per lb.	2/9	..
g White Anti-friction Metals .. per ton	..	..
k Zinc, Sh't (Vieille Montagne bnd.) „	Nom.	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

City and South London Railway Co.—Final dividend 2½ per cent., making 5 per cent. for the year on the 5 per cent. pref. stocks, carrying forward £9,027.

Kensington and Knightsbridge Electric Lighting Co., Ltd.—Final dividend on the ordinary shares 4 per cent., making 7 per cent. for 1915, as compared with 9 per cent. for 1914.

Newcastle and District Electric Lighting Co., Ltd.—Owing to war conditions no dividend is recommended for 1915. For 1914 3 per cent. was paid.

London Electric Supply Corporation, Ltd.—Dividend on the ordinary shares 3 per cent. for 1915, as compared with 4 per cent. for 1914.

Tottenham District Light, Heat and Power Co.—The electricity department receipts for 1915 were £574, and the expenditure was £547; balance £27.

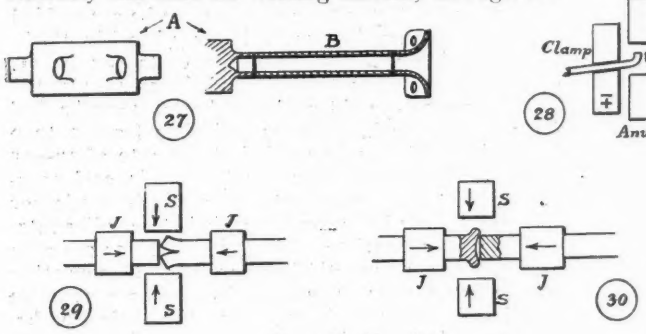
NOTES ON ELECTRIC WELDING PRACTICE.

(*Concluded from page* 184.)

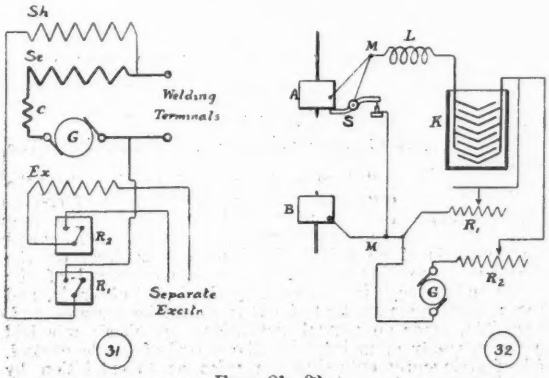
As a final example, fig. 27 shows the Clarkson system of building up steel wheels for automobiles by butt welding. Radial bosses on the drop-forged nave A are drilled and machined externally to form a short tubular section of diameter and area equal to that of the tubular spoke B, which is then welded in place. At the outer end a rim attachment, consisting of a tubular section (equal to that of the spoke) expanding in the form of an elliptical "bell" to the curved flange plate, is welded to the spoke, and the rim is then shrunk on after machining the periphery of the attachment plates. An exceptionally strong and neat construction results.

"*After-working.*"—After completing an electric weld, and usually whilst the metal is still hot, a thermal or mechanical treatment may be given with a view to relieving possible internal stresses, hardening or softening, or to remove or re-fashion extruded material. In arc welding the arc may be "played" by a skilled workman so as to prevent severe contraction stresses being set up, and it is common to hammer the joint by hand whilst it is cooling. Percussive welding does not heat the work appreciably; no thermal after-treatment is required, and the only mechanical finishing necessary is to grind off the fin which is quite thin but usually sharp.

If it is required to anneal a butt welded joint, it is only necessary to increase the jaw separation somewhat and pass a gradually decreasing current (considerably less than the welding current) through the joint. If the material has to be hardened it can be heated to any desired degree electrically and then quenched. Opening and closing the switch so as to pass the full welding current intermittently is a possible means of causing moderate heating, but is not recommended for regular practice. Incidentally, it may be noted that "resistance heating" in a butt



FIGS. 27–30.



FIGS. 31–32.

or spot welder can often be used very advantageously to heat parts for bending, forging, hardening or annealing, whether or not welding is actually performed. Annealing is essential at welded joints in high carbon and certain other alloy steels. On the other hand, a weld in copper is soft, so that if the joint is in wire which has to be redrawn, the whole should be annealed.

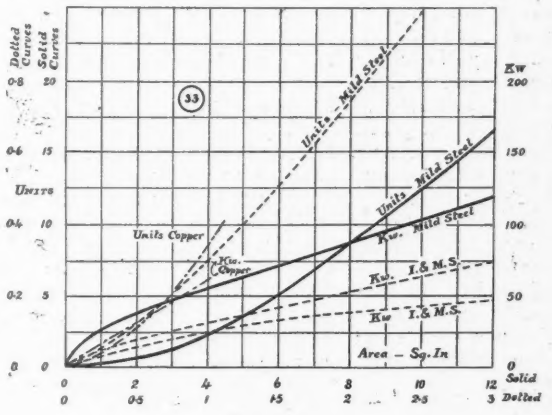


FIG. 33.

Often it is desired to leave a welded joint of the same size as stock in which it is made. This is practically the case if sheets are chamfered and arc

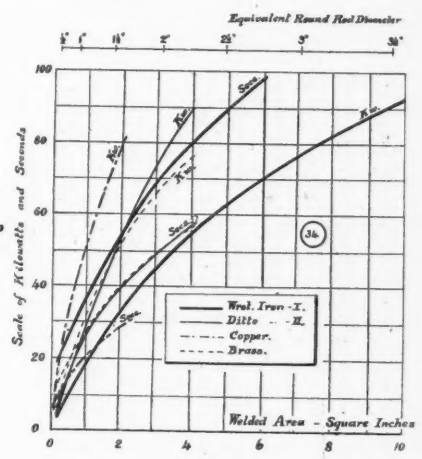


FIG. 34.

welded, but in butt-welding a burr is necessarily formed, which may be swaged down by hand or automatically by hammering or pressure. Fig. 28 shows in principle a means of overcoming the difficulty of true edge-to-edge butt welding between thin sheets and also of reducing and smoothing the burr formed.

To form a smooth joint between two bars the end of one may be split and splayed as in fig. 29, or shaped as in fig. 30, so that when welding heat is reached, and the jaws JJ and swaging blocks SS are all moved inwards, practically a cylindrical joint remains. There is obviously a risk that full welding heat will not be reached all over the section and that foreign material may be included in the joint. For most purposes a plain butt joint is simplest and best, the burr being ground off if necessary. The object of the special arrangements shown in figs. 29 and 30 is not so much to avoid a burr (which could be ground off) as to prevent shortening the stock whilst still permitting that displacement of metal at the moment of welding which is necessary for satisfactory union. A method serving the same end and tending to greater reliability in the body of the weld is to force in a "filling" pellet or strip of metal at the joint, subsequently grinding off surplus material.

Current Supply, Regulation and Consumption.—Generally welding equipments are sold complete and installed under expert supervision so that arrangements for current supply are generally suited to the

work to be done. Though well known to every electrical engineer, it is not so generally appreciated amongst those using or interested in welders that only 50 or 60 volts is needed or can be used effectively by a carbon arc (less by metal arcs), so that a low voltage motor generator is generally good business. A constant current generator overcomes much of the difficulty of drawing a steady arc of suitable intensity on the work itself. Connections for the Kramer constant current, commutating pole dynamo are shown in fig. 31, where C represents the commutating pole winding, *se* a differential series field winding, *sh* a shunt field system, and *ex* a separately excited fine wire field winding. By adjusting the regulator R1, the dynamo voltage is controlled whilst the regulator R2 adjusts the welding current. Once adjusted, the latter remains constant over a considerable range of weld resistance (*e.g.*, 150 amps. from 0 to 0.5 ohm weld resistance, falling to 100 amps. at 1.1 ohms). Since a single arc welder is rarely employed, and since some hundreds of amperes each is a reasonable average, supply has to be taken from power or traction mains, and this renders a low voltage set commercially essential. The latter should be used with a switchboard containing voltmeter and ammeters, controllers for the motor and compound generator, and an automatic short circuiting switch. Alternating current is not suitable for arc welding.

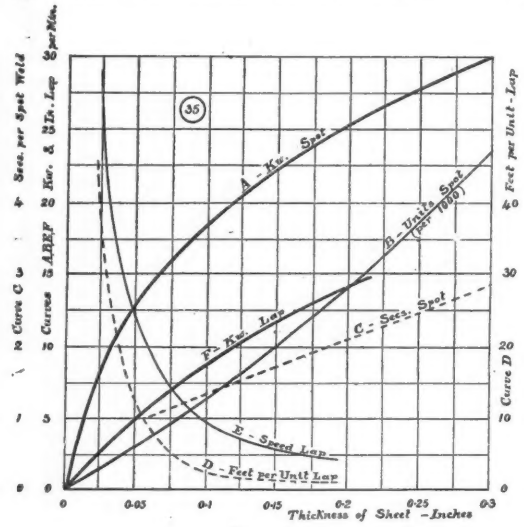


FIG. 35.

Percussive welding needs only a large electrolytic condenser and charging motor generator, the general arrangement of the circuit being as in fig. 32, where G is a C.C. dynamo charging a discharge circuit R1, K, L through a variable high resistance R2. The switch S short circuits the lines MM whilst work is being inserted in the welding jaws AB. By a suitable mechanical device, the switch S is opened (permitting K to become charged), and the falling jaw A is released practically simultaneously. The welding action which occurs directly the piece A reaches B has been described already.

The current consumption in a butt weld is reckoned by thousands or ten thousands of amperes, though the p.d. required across the weld is only a few volts. Obviously alternating current supply is the only practicable solution, primary supply at 100 to 500 volts, single phase, 50 cycles being convenient. Regulation of the secondary current may be by reactance in the primary, by varying the primary turns or by varying the supply generator excitation if a special generator be used. Varying the effective primary turns, say to 75%, 50%, and 25% maximum, by a plug switch (this eliminating the risk of short-circuiting turns), gives coarse control which can be amplified by finer sub-division, by reactance, or, to some extent, by varying contact pressure between the pieces heated. The circuit is naturally opened in the primary to save damage to switches, jaws or work, by attempting to interrupt the heavy secondary current directly. If considered necessary, a choker with rising and falling core can be used to smooth out the current demand. All but very heavy welders can be run unbalanced on one phase of a 3-phase power network.

As regards actual energy consumption, this has formed the subject of a number of special papers and articles, and really demands detailed treatment since the mechanical form of the work modifies considerably the energy consumption for a weld of given area (an extreme case, for example, being the difference in consumption for a weld between two bars and a weld in a small ring of the same sectional area). Within comparatively wide limits, and particularly in the case of butt welding, a satisfactory joint can be made with a certain current for a certain time, or with a less current for a longer time. Naturally the energy consumption is greater in the second case, owing to the greater heat losses, and for every piece of work there is a best all-round current and time. The permissible range of current is much greater with wrought iron or mild steel than with brass or aluminium.

A collection of curves based on data from a variety of sources is presented graphically in figs. 33-35; figs. 33 and 34, referring to butt welding, and fig. 35 to spot and lap welds: the curves can only be accepted as a general guide, since the number of variables is great and their effect complicated. Somewhere about $\frac{3}{4}$ cb. in. of metal per KW.-hour can be filled into blowholes, etc., using a metal electrode arc process, and from 10 to 20 ft. per hour of seam can be arc welded in steel plate according as the latter is $\frac{1}{4}$ to $\frac{1}{8}$ in. thick. On repetition work surprising outputs can be attained in butt and spot welding machines, though the actual figures depend largely on the exact mechanical form of the work. Hoops and tires from 2 to 9 inches in width can be welded at the rate of 10—15 per hour; 600 to 1,000 or more spot welds, each equivalent to at least one rivet, can easily be made per hour, and chain links can be welded at a similar rate.

An immense variety of electric machines are now available to meet practically any needs. One or other of the basic systems, arc, resistance or percussive welding, is employed in each case, the distinction between the innumerable machines operating on each system lying in such important mechanical details as jaw opening and closing gear, upsetting mechanism, contact cooling, and general arrangement of controls. The art and science of electric welding have been brought to such perfection that there are few metal-using industries in which electric welding does not or could not find very advantageous application.

BRITISH TRADE AFTER THE WAR.

(*Concluded from page* 165.)

On the subject of trade exhibitions, the Sub-Committee says:—

Trade Exhibitions.

"It was the general opinion that the organisation by private enterprise of exhibitions for financial profit, including and encouraging retail stalls, entertainments and side shows, is of no substantial benefit to traders; on the other hand, the highest appreciation was expressed of the British Industries Fair organised by the Board of Trade, and it was urged upon us that the Fair should be repeated and, if possible, made an annual institution. Emphasis was laid on the necessity of maintaining the Board of Trade control, and of stringently enforcing the rules as to exhibition by manufacturers only, and the exclusion of the general public. It was also suggested that the longest possible notice should be given, so as to give over-sea buyers ample opportunity to attend. The B.E.A.M.A. represented that in their opinion the expenditure of Government money on British participation in recent international exhibitions abroad had not greatly benefited British industry."

The Committee recommends that the following broad principles should be adopted in respect of future trade exhibitions:—

(*a*) Trade exhibitions should be held under the control of the Board of Trade.

(*b*) Exhibitions should be exhibitions of manufacturers' wares for traders, and should not be organised with a view to attracting the general public.

(*c*) Exhibitions should not be too general in scope, but should be for a limited number of branches of industry at a time, according to the importance and dimensions of each particular industry in this country.

(*d*) At least one year's notice of the intention to hold any particular exhibition should be given to manufacturers.

Trade Marks.

As regards the Merchandise Marks Act, practically all the witnesses urged that the provisions of the Act should be strengthened so as to require compulsory marking indicative of foreign origin, that such marking should be on every imported article to which the requirement extends, and that mere marking of the wrapper or other packing should not be sufficient. In the case of glassware it was suggested that the marking should be in the glass itself. A number of witnesses expressed strongly the opinion that goods of enemy origin should be marked distinctly with the name of the country of manufacture, and not with some less definite indication, such as "foreign made" or "not British."

"Some of the witnesses urged that the Customs should prevent the entry into this country of goods which bear infringing trade marks, but it would appear that the existing arrangements in this respect are not fully known or understood. We understand that the Customs have at present a system of registration of trade marks, the property of manufacturers, dealers, or traders in this country. Under this system a manufacturer who has reason to believe that his name or trade mark is one not unlikely to be imitated so as to constitute a forgery may apply for registration for his name or mark. On such registration being completed the Customs officers are apprised, and in the event of any goods bearing such name or trade mark being observed by them in the course of their examinations, the firms registering are immediately informed, and on their statement that the marks are infringements, the detention of the goods is continued. A bond is entered into by the firm to cover this detention, and unless some satisfactory arrangement is concluded between the importer and the possessor of the infringed mark the goods are in due course confiscated."

The Committee received various representations respecting the protection of British trade marks abroad. Its recommendations are as follow:—

(*a*) All German and Austrian goods imported into the United Kingdom should be required to be marked with an indelible mark "Made in Germany," or "Made in Austria-Hungary," and goods imported from other foreign countries should be similarly marked either with the country of origin or with the words "Foreign made" or "Not British." Such marking should be in all cases on the actual goods, and not merely on the package.

(*b*) Alien firms and alien-owned companies should be prohibited from registering in the United Kingdom trade marks containing English words.

(*c*) The Government of India should be urged to reconsider the question of the establishment of trade mark registration in India.

(*d*) As regards the entry into this country of goods bearing infringing trade marks, there seems nothing to complain of in the Customs practice set out in the above quotation, as a public department cannot be called upon to undertake actions for the protection of private rights, and we endorse it, but there is an additional requirement which should be put into force, viz.:—

"As a part of the information to the firm affected by the infringement, there should be supplied as a matter of course, the names of the consignor and consignee, which have hitherto been withheld on the ground that the Customs have no power to give the required information, which is in many cases actually in their possession. In cases where shippers, or brokers, are alone concerned in the importation, the Customs should be enabled to require full information as to the original consignor, and the actual consignee, as a condition of entry of the goods, and this should be effected by legislation, or by regulation, as may be found necessary. In support of this view it is only necessary to point out that the first step in any action for infringement is to ascertain the identity of the infringer, and that this should be withheld by a British department, when in its possession, is wrong as a question of policy, and really amounts to a screening of the offending foreigner, and the confederate recipient in this country, who is often a mere agent of the consignor, occupying a small office. The Customs should, therefore, in our opinion, be furnished with necessary powers and required to use them when granted."

"His Majesty's Consular Officers should be directed, so far as practicable, to watch for, and report immediately with the fullest details obtainable, cases of the apparent infringement of British trade marks, or attempts to pass off foreign-made goods as British."

A Ministry of Commerce.

The B.E.A.M.A. and the Paper Makers' Association made suggestions on this subject. The Committee says that the suggestion is believed to be due "to a feeling in trade circles that the great variety of duties which the Board of Trade has to discharge unavoidably prevent that concentration of attention on commercial and trade matters which is desirable." The B.E.A.M.A. further urged that it should be the duty of the Ministry of Commerce not only to promote trade but "to champion its cause against any other Department which seeks to impose restrictive conditions." The Association's witnesses took exception to the connection of a Ministry concerned in the development of trade with a Department which issues "regulations as to public safety and all the numerous regulations which emanate from the Board of Trade."

On this point the Committee recommends:—

"H.M. Government should be urged to consider anew the advisability of establishing a separate Ministry charged solely with the safeguarding and extension of British industry and trade, and freed from the regulative duties in respect of Railways, Shipping, and Harbours, and the duties in respect of Labour, which at present devolve upon the Board of Trade."

Trade Commissioners and Consuls.

It was suggested to the Committee that the system of Trade Commissionerships under the Board of Trade, which has proved so successful in the Self-Governing Dominions, should be extended to the principal foreign countries. "We heard a certain amount of criticism of the Consular Service. Whilst no doubt there has been justification in the past for some of the complaints as to the inattention of Consular Officers to commercial matters, and their inexperience in regard to them, and weak spots are still to be found in the existing organisation, we think that the general level of the Consular Service in this respect has risen appreciably in recent years. We are of opinion that more weight should be attached to commercial knowledge and experience in the appointment of Consular Officers, though we recognise that other considerations must be taken into account; but in regard to both Trade Commissioners and Consular Officers we may point out that we are informed by the Board of Trade that numerous complaints are received from both classes of officials that British traders and their travelling representatives do not make sufficient use of them, and that the officials are thereby deprived of the opportunities which they desire to have of obtaining at first hand practical information as to the particular ways in which they might be of service to British manufacturers and merchants."

The Committee recommends on these points:—

"The appointment of Trade Commissioners responsible, and reporting directly, to the Board of Trade, should be extended to the principal foreign countries."

"The organisation of the Consular Service should be dealt with so soon as possible after the completion of the Report of the Royal Commission on the Civil Service, with a view to the increase of its commercial utility."

The Metric System.

The B.E.A.M.A. urged that a Government inquiry should be instituted into the desirability of adopting decimal coinage and the metric system both for this country and in the Dominions. "The use of the metric system is, of course, already permissible; as to any Government action beyond that we are aware that opinion is divided; and we content ourselves with recording these suggestions."

Travellers and Catalogues.

The Committee recommends:—"Representations should be made to the Governments of the Self-Governing Dominions and of the Colonies with a view to the preferential treatment of British commercial travellers in respect of licence fees."

"Representations should be made to the Governments of such British possessions as levy import duties on imported catalogues and trade circulars, with a view to the substantial reduction of such duties in respect of the catalogues and circulars of British manufacturers."

Technical Training.

The Committee refers briefly to the "insufficient importance attached in this country to technical training, in spite of the progress made in some directions, and the advantages which the manufacturers of Germany have derived from the more developed and systematic schemes in operation there. Suggestions as to the failure by employers and employed alike to appreciate the full importance of technical training were made in several instances. "We were glad to learn, however, that in the glass industry there are signs of a marked improvement in this respect."

Those Continental Tours.

We can almost hear the smile of some of our readers as they remember some electrical excursions which may not have been in the mind of the Committee when it penned the following:—

"The other matter to which we would direct attention is the attraction which Continental buying exercises upon British distributing houses. The periodical visit to the Continent, combining a business tour with a pleasant holiday, and the entertainment provided by German manufacturers, presents strong attractions to the representatives of British distributing firms, and is not likely to be given up by them unless there are very strong motives for such action. The cumulative effect of this particular consideration on a large number of firms in leading them to prefer to deal with Continental makers, even when British firms are offering goods of similar quality at competitive prices is, we think, very considerable."

Tariff Protection.

The Committee says that the preceding matters were, in the representations made to it, of secondary importance in comparision with the question of the possibility or otherwise of tariff protection after the war. Practically all the representative firms and associations consulted asked for a measure of Protection. The reasons advanced were as follow:—

"There is a general fear that, immediately after the war, this country will be flooded with German and Austro-Hungarian goods, sold at almost any price, and that the competition in price which was going on before the war will be accentuated, with resultant serious difficulty to all manufacturers of goods of kinds exposed to this competition, and positive disaster to those manufacturers who have been encouraged to extend their operations, or engage in new branches of industry, with a view to capturing trade hitherto carried on by enemy countries.

"The causes of the ability of German firms in the past to undersell their British competitors, on which most emphasis has been laid in the representations made to us, are:—

"(*a*) The low railway rates charged in Germany on goods for export, and other transport advantages.

"(*b*) The industrial combinations in Germany, which, with a large home market secured to them by the tariff, were able to produce on a large scale and to dispose of their surplus product abroad at very low prices.

"(*c*) The low rates of wages prevailing in certain industries in Germany.

"In some cases it was admitted that lower wages are not the cause of the lower prices at which German goods are offered. Thus we were informed as regards paper-making that 'the labour bill, for the same class of output, is much the same in Germany as in Bury'; that in the electrical industries 'in 1913 hours of labour were slightly longer in Germany than in England, wages were about the same in the two countries, and the standard of labour was better in Germany.'

"The conviction that the prices at which German goods will be offered in the British and neutral markets after the war will be even lower than the pre-war quotations is based on two assumptions—first, that in some branches of industry at least Germany has been accumulating large stocks during the war, and secondly, that immediately upon the conclusion of peace she will make every effort to recover her position in the world's markets, and to crush nascent competition, and that in carrying out that policy cheapness will be a potent weapon. Whatever may be the truth as to the accumulation of stocks, we do not think the validity of this second assumption is open to doubt."

Magnetos.

The Committee directs special attention to magnetos:—

Prior to the outbreak of the war the trade in magnetos, which are of great importance for all forms of motor-cars and aircraft, as well as for other purposes, was virtually monopolised by the Bosch Co., of Stuttgart, a very powerful organisation with great resources. The result was that at the sudden commencement of the war there were no manufacturers in this country, where the normal demand was about 5,000 magnetos per week; since then it has substantially increased, especially for military and naval purposes. A number of British firms took up the manufacture, and with the assistance of Sheffield in respect of the production of magnet steel, they have succeeded in making magnetos which have passed the Government tests and are asserted to be as good as the Bosch products. The firms are receiving large Government contracts, and there seems to be no doubt that in this instance (which is specially important as being one of a "key" industry) a considerable British manufacture could be built up which, *inter alia*, would guard against a repetition of the serious difficulties caused in the early stages of the war by our dependence on foreign supplies. The one obstacle is the reluctance of the firms concerned to commit themselves to further capital outlay, and the unwillingness of outside capital to come to their assistance, unless assured of some security against the strenuous efforts which the powerful Bosch concern will undoubtedly make after the war to break down the new British enterprise. The representatives of this industry asked that Government assistance might be afforded them in the shape of (1) an undertaking that the Government Departments concerned in motor transport and the air services would undertake to make use only of British magnetos made (so far as practicable) only of British parts—such undertaking to be for a term of years after the conclusion of the war; and (2) the extension to all magnetos of the import duty of 33⅓ per cent. imposed upon magnetos imported as parts of motor cars. We reported to the President of the Board of Trade that, in view of the importance of the manufacture of magnetos for military and naval purposes, its position as a "key industry," the efforts which the manufacturers have made, and the undoubtedly severe competition from the powerful Bosch interests which they will have to encounter after the war, we were unanimously of opinion that Government assistance might be given in the two forms desired by the industry.

The amount of the tariff duties which it was suggested should be imposed naturally varied with the different branches of industry.

The B.E.A.M.A. Protection Proposals.

The following resolution, recently passed by the Council of the British Electrical and Allied Manufacturers' Association, was communicated to the Committee:—

"Resolved, that it is the considered opinion of the Council of this Association that the Government should, as soon as possible, proceed to formulate a tariff scheme, embodying:—

"1. An Imperial Customs Union between Great Britain and her overseas Colonies, Dominions and Dependencies, with a view to the adoption at some later period of free trade within the British Empire.

"2. A tariff on all goods imported into this country which are such as can be efficiently and economically manufactured in British workshops.

"3. That a substantial preference should be given to all goods, whether manufactured or otherwise, imported from any portion of our overseas Empire.

"4. That a smaller preference than the foregoing be given to those countries which are now allied with us in defending the right of national existence against the dominating influence of the Central European Powers.

"5. That such preference as may be possible, having in view the balance of trade between nations, be given to neutral countries.

"6. That the duty imposed on goods of Austrian and German manufacture should be of a highly protective character, not only in Great Britain, but also in the overseas parts of the Empire."

Some other suggestions were put forward for the protection of British manufacturers in other ways. These are:—

(*a*) The confiscation of, or imposition of a substantial duty on, imported goods unaccompanied by a British Consular certificate to the effect that the goods are not invoiced to this country at a lower price than would be obtained for them in the domestic market of the country of manufacture (*i.e.*, "anti-dumping" legislation).

(*b*) Restriction of British Government contracts to British goods, or a preference to such goods in respect of price. The reasonableness of this claim was strongly urged upon us by representatives of the new magneto industry, and also in the case of table glassware.

The British Science Guild reported that a large number of educational institutions and authorities had already undertaken not to purchase any chemical glassware of foreign manufacture for a period of three years after the war, provided that an adequate supply of British manufacture is forthcoming.

(*c*) That in respect of the raising of loans or the levying of taxes by municipalities or public bodies for carrying out works of public utility, it should be a condition imposed by the Central Government that preference be given to British manufacturers. Such preference might, it was suggested, be limited to 10 per cent., as a check upon trade combines.

The Committee Recommends Import Duties.

On this matter the Committee recommends:—

"*Tariff Protection.*—Where the national supply of certain manufactured articles, which are of vital importance to the national safety, or are essential to other industries, has fallen into the hands of manufacturers and traders outside this country, British manufacturers ready to undertake the manufacture of such articles in this country should be afforded sufficient tariff protection to enable them to maintain such production after the war. With reference to the strongly-expressed opinion of many of the witnesses that the enactment of protective duties on the industries other than those referred to in the preceding paragraph, which have formed the subject of our inquiry, is essential to their maintenance, we wish to report that in view of the following considerations:—

(*a*) That there exists a strong desire to respond to the feeling in our Dominions in favour of an Imperial preference in trade, and that there is also a strong desire to arrange preferential trading with those who are our Allies in the present war, and

(*b*) That the present high direct taxation tends to raise the rate of interest on money, and cheap and abundant capital for the employment of their labour is of the greatest importance to the working classes,

it will be necessary to impose some widely-spread import duties, and we are therefore prepared to recommend that a larger proportion of the revenue should be raised by reasonable import duties. We are of opinion that such import duties would go a long way towards satisfying the requests for special protective treatment for the industries which we have had under consideration. We would only add that in view of the threatened dumping of stocks which may be accumulated in enemy countries, the Government should take such steps as would prevent the position of industries, likely to be affected, being endangered after the war or during the period required for a wider consideration of the whole question."

Cold Water and a Reservation.

The recommendations of the Committee are subject to this consideration:—

"We are fully conscious of the limited range of the inquiry, and that the particular branches . . . cannot well be singled out for special Government action; our investigations have been devoted only to a comparatively small portion of the immense field of British industry, and the conclusions at which we have arrived might consequently be modified in some respects were the range of inquiry to be extended."

The signatories to the report are:—Algernon F. Firth; A. J. Hobson; Stanley Machin; E. Parkes; and Albert Spicer. (Percy Ashley, Secretary.)

Sir Albert Spicer adds a reservation in respect to the immediate enactment of protective duties, which concludes as follows:—

In view of these recommendations, which are all protective in effect, and of the fact that during the continuance of the war manufacturers are automatically protected, and that for some years after the war protection, equivalent to import duties, is likely to be afforded by the prejudice against German and Austrian goods, I feel that the consideration of a tariff for these special industries should wait until after the war, unless it can be undertaken earlier, when the whole issue can be again considered in the light of what, I hope, will be an agreed policy with our Dominions overseas and our present Allies.

Electrolytic Disinfectant.—Our contemporary, *Nature*, in a note on new antiseptics refers to the use of electrolysed sea-water for the disinfection of hospital ships, remarking that though the production of hypochlorite by the electrolysis of salt solution for bleaching purposes, and the powerful antiseptic properties of hypochlorite so produced, have long been known, the idea of electrolysing sea-water on the vessel which is to be disinfected is a novel one. It is due to Dr. H. D. Dakin, whose apparatus consists of an electrolytic cell, which, with a current of 65-75 amperes at 110 volts, yields a solution of two parts per 1,000 of hypochlorite at a cost of about 3d. per 100 gallons. This solution, diluted with an equal volume of sea-water, is sufficiently strong to sterilise floors, decks, latrines, &c. It has been used on the *Aquitania* on her last two voyages, with excellent results.

THE ELECTRIC ARC IN VAPOURS AND GASES AT REDUCED PRESSURES.*

By W. A. DARRAH.

A study of the light efficiency of an arc from a chemical standpoint, shows that there is a certain rather limited class of substances which, when introduced into the arc in small quantities, produce a very great increase in luminosity. Thus the addition of small quantities of cerium or calcium compounds to the carbon arc may increase its efficiency over 300 per cent., and the addition of titanium (preferably as an oxide) to the magnetite arc similarly produces an increased luminosity without a corresponding increase in energy consumption.

A study of these facts led to the conception that perhaps an arc could be maintained in a closed vessel and supplied with these light-producing elements in the vapour form. Titanium, tungsten, and other elements which increase the luminous efficiency of an arc, may readily be secured in the form of volatile liquids.

Preliminary tests having indicated the possibilities, as well as the difficulties to be overcome, lamps were constructed and a detailed study was made of the effects of the various available electrode materials, the different vapours, and different designs of lamp. A hard glass was employed, which allowed of the sealing of tungsten wires and rods directly into the globe with the aid of a flux of potassium nitrate and borax. This enabled heavy seals to be used. Figs. 1 and 2 show designs which were found fairly satisfactory.

The lamp consists essentially of a chamber at the centre of which an arc is drawn between tungsten electrodes about $\frac{1}{16}$ in.

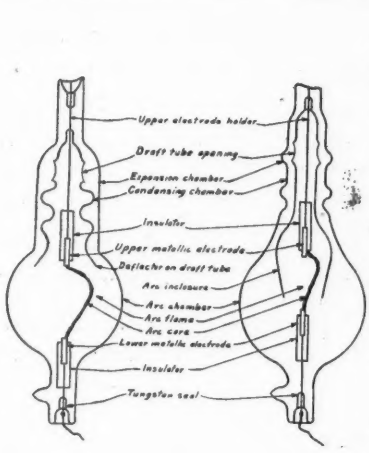


Fig. 1.

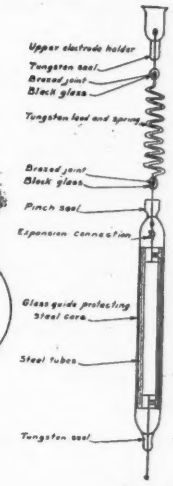


Fig. 2.

Fig. 3.

in diameter. The electrodes are partly surrounded with a refractory insulator, intended to keep the arc from moving far from the ends of the electrodes, as this allows the arc to extend and ultimately to rupture. The refractory insulator, also assists in keeping the electrodes at a high temperature, thus increasing the efficiency of the lamp and the stability of the arc.

The upper electrode is fastened by means of a tungsten rod to an iron core, which is surrounded by a glass shell to protect the iron from corrosion, as the vapours used readily attack nearly all metal except tungsten, platinum, gold, and a few other inert materials. A flexible tungsten spiral serves to conduct the current from the upper movable electrode to the upper seal, fig. 3.

It was found, after a number of trials, that a certain combination of gases gave a minimum amount of decomposition products, which gradually collected upon the globe, thus reducing the amount of light radiated. In order to overcome this difficulty, the arc chamber was extended above the upper electrode, thus forming a condensing chamber in which the soot could collect, allowing the walls to remain clean. A draught tube was placed around the upper electrode in such a position that the heated gases from the arc would pass upward through the draught tube out into the condensing chamber, and then back downward into the arc chamber for use again. The corrugations shown on the draught tube and condensing chamber were found to aid the condensation of the suspended matter.

The search for a satisfactory electrode material showed that carbon was unsatisfactory. Tungsten proved to be practically inert, even at a white heat, in the presence of the various vapours used. The tungsten terminals, moreover, did not melt or evaporate in the arc except at a very slow rate, which seemed to be comparable to the evaporation of the filament in an incandescent lamp.

The arc in this lamp is quite different from that of other commercial arc lamps (see fig. 4). It is usually very stable, about $\frac{1}{8}$ in. in diameter, tubular in form, and varies from 2 to 5 in. in length with 110 volts direct current, the variations being due to differences in pressure, nature of the gases supplied, &c. A high pressure increases the intrinsic brilliancy of the arc, but makes it necessary to operate at a shorter length, as the gas currents due to temperature differences and arc reaction are correspondingly more violent. The diameter of the central luminous tube is also reduced with an increase in pressure.

The general appearance is that of a thick intensely white incandescent filament slightly bent at the upper end. With some of the vapours, as, for example, the metaloid halogen compounds, antimony, phosphorus, and arsenic chlorides, the central tubular portion is surrounded by a ragged flame, which is light pink in the case of arsenic and pale green in the case of phosphorus.

The flame portion acts somewhat as an absorbing screen, thus reducing the total useful radiation. It is a curious fact that this flame may exist for a short but appreciable time after the circuit has been interrupted, thus indicating that it probably does not have a part in the conduction of electricity through the vapour, but appears to be a zone in which the vapours, after being dissociated by the heat and electrical effects of the arc, recombine. The spectrum of the flame is usually quite different from the arc spectrum, and is characteristic of the elements involved, while the spectrum of the arc independent of the ends of the electrodes (which, of course, give a hot-body spectrum) is usually a band spectrum, and is practically continuous except for a few absorption lines.

The electrical characteristics of the antimony pentachloride lamp are shown in fig. 5, plotted between arc length and voltage. The curve indicates that a 4-in. arc at 10 amperes requires no more voltage than a 1-in. arc at 2 amperes. A 10-ampere arc is four times as long as a 2-ampere arc, and its intrinsic brilliancy is

Fig. 4.

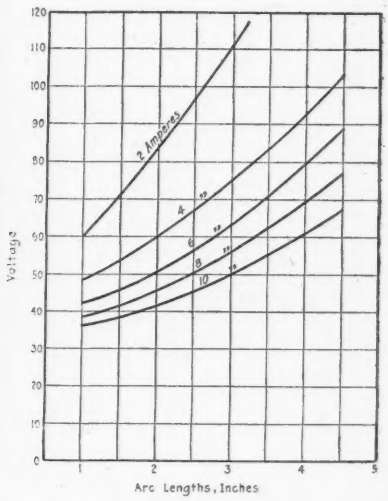


Fig. 5.

about five times as great; accordingly, the light emitted by it under these conditions is 20 times, and the efficiency approximately four times that of the 2-ampere arc.

The efficiency ranges from 1 watt per mean spherical candlepower to less than one-quarter of the value. This performance may be secured with a white light which closely resembles afternoon daylight (north sky).

While the results set forth in the paper offer considerable promise from a practical standpoint, they are not presented for consideration as representing a finished device, but merely a research in what seems to be a new and interesting field.

* Abstract of a paper read before the American Electrochemical Society, in joint session with the Illuminating Engineering Society, on November 11th, 1915.

Science and Industry.—On January 5th a conference was held in Melbourne to consider the Federal Government's proposal for the establishment of a national laboratory. The Prime Minister has stated that the Government intends to secure the services of the best scientific men available, and that the resources of Australia are to be systematically developed on scientific lines.

X-Ray Dangers.—Although the dangers attending the irradiation by X-rays are now generally recognised, risks are often taken unnecessarily, through want of thought or knowledge of danger on the part of operators. The rapidly increasing number of radiographic laboratories and installations have brought into the field many workers of limited experience, and there is fear that in the near future cases of X-ray dermatitis may develop among operators, nurses, and those working with X-rays generally, that would have been avoided by taking proper precautions. The Council of the Röntgen Society has, therefore, formulated an excellent card set of recommendations which, if followed, will give a large measure of protection from the known dangers attending the use of X rays, and it is suggested that the card, which is now ready, should be affixed in a prominent place in all departments where X-rays are generated.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

BRITISH DOMINIONS AND POSSESSIONS.—A Supplement to the *Board of Trade Journal* of January 13th contains lists of prohibited exports, classified under their respective headings in alphabetical order, from British India, the Self-Governing Dominions (other than Australian), Egypt, and certain other British Possessions. The information in the present Supplement supersedes that given in the Supplement dated October 14th last, and the lists have been amplified by the inclusion of particulars for Malta, Mauritius, Jamaica, Barbados, and British Guiana. Copies of the Supplement may be obtained, price 3d., from the usual sale agents for Government publications.

FRANCE.—In virtue of a Decree of the French Minister of Finance, dated December 10th, certain goods whose exportation and re-exportation had been prohibited by a Presidential Decree dated December 7th, are allowed to be exported or re-exported from France, without special authorisation, when consigned to the United Kingdom, the British Dominions, Colonies, and Protectorates, Belgium, Japan, Montenegro, Russia, Serbia, or American countries. The list of articles includes the following:—Accumulators and accumulator plates; manufactures of aluminium and oxides; antifriction metal; copper, pure or alloyed, in all forms; electrodes, electric batteries and their elements; tin, pure or alloyed, in all forms; engine and boiler packing, including slag wool; manganese (metal) in all forms; mercury (compounds and preparations of); molybdenum (salts of); worked mica; nickel, pure or alloyed, in all forms; salts of copper, chromium, tin and mercury; silicon; sulphates of soda and zinc; titanium (salts); tungsten (metal) in all forms; vanadium salts; zinc manufactures.

BRITISH INDIA.—The exportation of mica has been prohibited from British India to all countries except the United Kingdom and British Possessions, as from November 19th last. The prohibition does not, however, apply to goods shipped by or for the use of the Crown.

SOUTH AFRICA.—Customs decisions have recently been issued in the Union of South Africa and also in Southern Rhodesia in virtue of which the rate of import duty on concentrated accumulator acid (consolidated sulphuric acid) is to be 20 per cent. *ad valorem* under the general tariff. In the Union of South Africa the rebate allowed to the product of the United Kingdom or of reciprocating British Possessions is 3 per cent. *ad valorem;* in Southern Rhodesia, however, the rebate is fixed at 9 per cent. *ad valorem,* and is allowed to all British Possessions, whether reciprocating or not.

By a further decision of the Union of South Africa Customs Authorities the duty leviable on commercial silica under the general tariff is 20 per cent. *ad valorem,* with a rebate of 3 per cent. *ad valorem* to the product of the United Kingdom or reciprocating British Possessions.

NETHERLANDS.—A Dutch Royal Decree dated December 10th prohibits the exportation of graphite and articles made therefrom, whether as raw material or manufactured, unless forming parts of manufactured articles of which graphite is not the main component part.

FRENCH COLONIES.—A French decree dated December 27th provides that mica in sheets or leaves, and micanite (the exportation of which was prohibited by a decree of December 9th) may be exported and re-exported, without special authorisation, when consigned to the United Kingdom, the British Dominions, &c., Belgium, Japan, Montenegro, Russia, Serbia, or American countries.

SWITZERLAND.—By a Swiss Federal decree of December 30th, the exportation from Switzerland of asbestos, mica and micanite—in sheets, even if combined with tissues; and in pipes and other specially-shaped articles, even if combined with other materials—is prohibited as from January 3rd.

STATE OF BRUNEI.—Revised import and export duties have recently been announced in the State of Brunei, among which may be noted an export duty on Para and other cultivated rubbers of 2½ per cent. *ad valorem.* Formerly, rubber was not specifically tariffed.

PORTUGAL.—A Portuguese decree dated December 27th prohibits, as from the date of the decree, the exportation of certain articles from Portugal and the adjacent islands. By way of exception, the Minister of Finance may permit, in certain circumstances, the exportation of these articles on payment of special export surtaxes in addition to the ordinary export duty. Among the articles included in this restriction are the following:—

	Rate of surtax.
Tin or tin ore	1½ per cent. *ad valorem.*
Copper ore or cement	1 per cent. *ad valorem.*
Wolfram	30 escudos per metric ton.
Other ores not specified	1½ per cent. *ad valorem.*
Articles of copper, brass and tin	8½ per cent. *ad valorem.*

SPAIN.—An export duty on zinc in bars, lumps, cake, and scrap of 100 pesetas per 100 kilogs. net came into force in Spain on January 3rd, in virtue of a Spanish Royal Order.

EAST AFRICA PROTECTORATE.—New regulations dated November 10th, 1915, have been issued in the East Africa Protectorate amending the requirements as to Certificates of Origin for goods imported from certain foreign countries. Certificates in the prescribed form must be presented to the Chief of Customs in respect of all goods imported into the Protectorate in trade with any foreign port, other than British ports, with the exception of those of Russia, Belgium, France, Italy, Spain, and Portugal, provided, however, that in respect of goods transhipped in the United Kingdom a duplicate of the "Specification for Foreign and Colonial Merchandise" (Form 30) or the Shipping Bill (Form 64), signed and stamped by the proper Officers of Customs in the United Kingdom, may be accepted in lieu of the Certificate of Origin. For the present, however, such Certificates will not be required in respect of individual consignments not exceeding £25.

BRITISH GUIANA.—The "Customs Duties Ordinance, 1916," provides for the imposition of duties on goods imported into and exported from British Guiana, with effect to December 31st, 1916, unless otherwise enacted. The rates of duty leviable under the new Ordinance are practically the same as those previously in operation.

NEW PATENTS APPLIED FOR, 1916.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

1,469. "Electrical selectors or impulse responders." L. C. Bygrave and Relay Automatic Telephone Co. January 31st.

1,472. "Cells or boxes for secondary batteries." E. J. Clark & Hart Accumulator Co. January 31st.

1,475. "Miners' electric safety lamps." O. Oldham. January 31st.

1,481. "Make-and-break switches." E. Girardeau. January 31st. (France, January 29th, 1915.)

1,483. "Electro-magnetic release or cut-out." A. Fantini. January 31st.

1,502. "Testing arrangements for machine telephone switching systems." Western Electric Co. (Western Electric Co.). February 1st.

1,526. "Electric motor pump." S. Kawakami. February 1st. (Japan February 5th, 1915.)

1,540. "Impulse senders." Relay Automatic Telephone Co. February 1st.

1,550. "Protective gear for alternating-current feeders and circuits." A. E. McColl. February 2nd.

1,595. "Transmission of wireless signals." Galletti's Wireless Telegraph and Telephone Co. & R. C. Galletti. February 2nd.

1,596. "Electric heat radiators." A. F. Berry. February 2nd.

1,597. "Radio-telegraphy." J. Bethenod & E. Girardeau. February 2nd. (France, February 2nd, 1915.)

1,609. "Electrically-operated ordnance, machine guns, &c." J. M. Echavarria & W. G. Grattan. February 2nd.

1,617. "Mercury contact and short-circuiting devices for electrical measuring instruments." A. L. Davis. February 3rd.

1,620. "Means of equalising or balancing electric currents, applicable to rotary converters." C. C. Garrard & A. H. Railing. February 3rd.

1,628. "Electrolytic apparatus for laundry, &c., purposes." E. Reuss & V. Roberts. February 3rd.

1,635. "Electric joint." G. H. Scholes. February 3rd.

1,698. "Electric batteries." H. F. Joel. February 4th.

1,705. "Means for controlling alternating currents." British Thomson-Houston Co. (General Electric Co., U.S.A.). February 4th.

1,707. "Electric heat-regulating switch." J. Kiell. February 4th.

1,724. "Electrical resistances." Clarke, Chapman & Co. and R. C. Harris. February 4th.

1,746. "Electro-plating tubes." J. D. Carlmark (trading as Electric Engineering & Plating Co.). February 5th.

PUBLISHED SPECIFICATIONS.

1914.

24,698. Aerials for Wireless Signalling. Marconi's Wireless Telegraph Co. & C. S. Franklin. December 15th.

1915.

677. Electric Cable Sockets. C. Pressland. January 15th.

1,212. Thermostatic Electric Switches. W. T. Pritchard. January 25th.

1,214. Electric Generators and Motors. M. M. Cardellino. January 25th.

1,234. Stranded Electrical Conductors for Overhead Power Transmission. M. Höchstädter. January 26th. (Convention date not granted.)

1,284. Electrical Controlling Apparatus for the Tool Carriers of Metal-working Machines. "Vulkan" Maschinenfabriks Akt. Ges. January 26th. (February 2nd, 1914.)

5,883. Method of obtaining a Sparkless Break of an Inductive Electrical Circuit. T. F. Wall. April 20th. (Cognate application 6,253/15.)

8,524. Electric Vulcaniser. O. C. Dennis. June 9th.

10,901. Manufacture of Electric Apparatus comprising Insulating Parts made by Moulding. M. Segre. July 27th.

10,902. Method of Screw Threading Articles made of Horn or Analogous Substances of Fibrous Structure. M. Segre. July 27th.

11,660. Arc Lamp with Enclosed Voltaic Arc. Allgemeine Elektricitäts Ges. August 12th. (August 13th, 1914.)

12,143. Electrical Switchgear. E. A. Graham. August 23rd.

12,924. Electric Heating Apparatus. G. Pate & A. R. Wood. September 9th.

15,369. Telephonic Receivers. E. A. Graham. November 1st.